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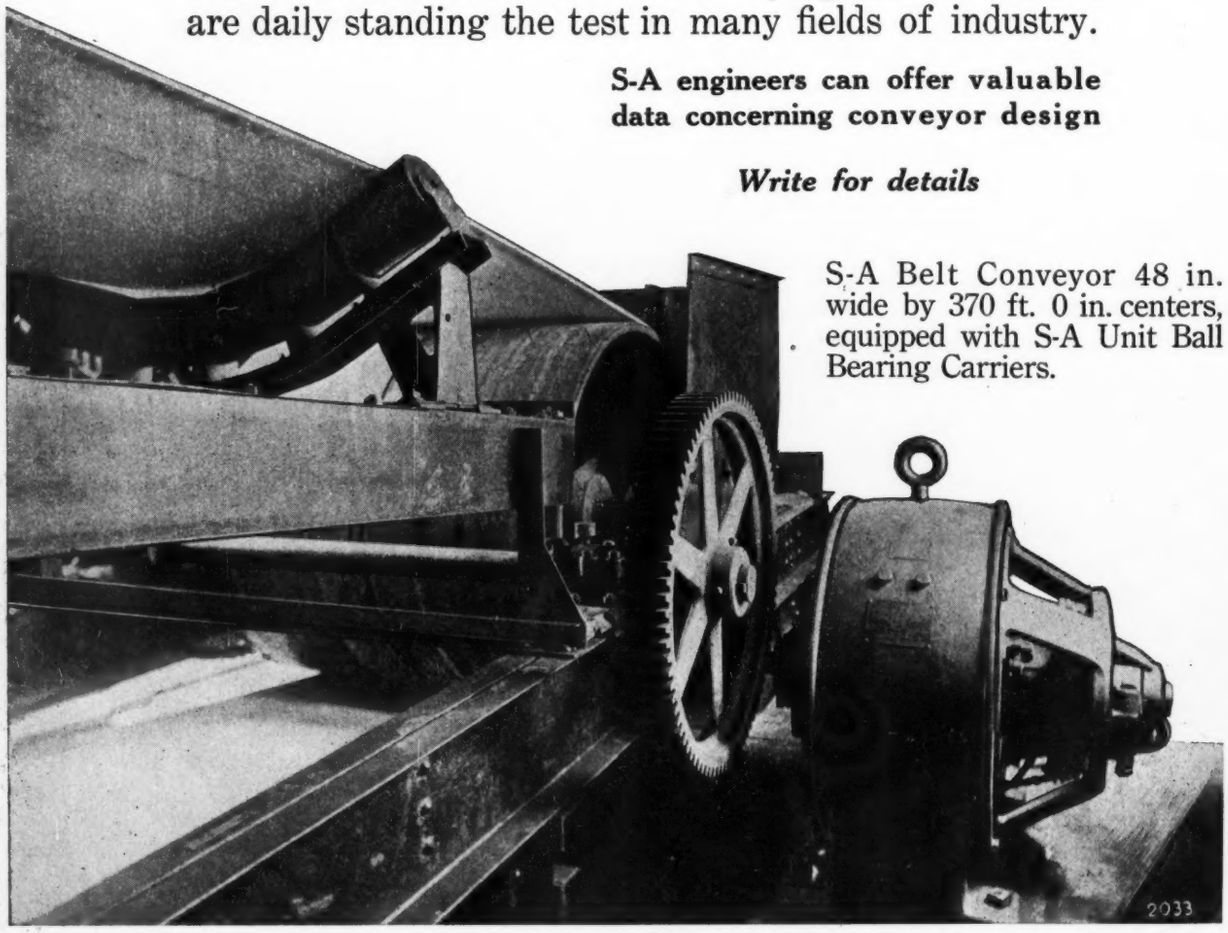

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A Question of Policy

What shall be the policy of the Engineering and Mining Journal with relation to vital problems which affect the mineral industries? That is a question which we have to think over and decide at the start, and we don't mind thinking aloud—it may help. First, it seems clear that the Journal covers and represents the whole field of the mineral industries—not only that of the miner, but the smelter, the dealer, and the consumer. The ties between all are so close that no one of these nowadays can transact his business intelligently without understanding the whole cycle; and an increasing number of organizations combine two or more of these functions.

There are no strings on the Journal or its editorial staff. It is neither subsidized nor financed by mining or smelting interests or by those of the consumer; but it is plain that the welfare of all is vital. Substantially, then, the mineral industry of the United States is its field. But the American mineral industry is not confined to American territory. It reaches into Mexico and South America; and in a lesser degree into Europe, Asia, and Africa. We believe in the protection by our Government of the rights of American industry abroad, and in the theory of commercial auræ or penumbræ around the nation, which, although diffused in varying degree, still retain the rights and duties of nationality. Beyond all this is the international situation with which we are each day more closely bound, as members of a shadowy, waxing and waning, but ever more clearly defined, world brotherhood. We have many readers in Australia and Japan, for example, who look to us for a clear and fair presentation of facts concerning the mineral industries elsewhere.

Thus far, all plain sailing. Let us suppose, however, that a flourishing abrasive (garnet and corundum) mining industry could be developed in the South, by subsidy or protection, but that the change would be disadvantageous to abrasive consumers, would cause a lessened consumption, and the adoption of substitutes of inferior quality by manufacturers at an equal or greater cost to the final consumer. What then? Let us suppose, similarly, that any section of the country has its new baby of a mining industry, which it desires to have fed by the country at large, at the expense of the diet of the rest of the family. Shall we fight the battles of the kid because his last name is Mineral, and we belong to that clan?

Our representative government, our legislative bodies—whether municipal, state, or national—operate more or less fully and frankly, on the basis of sectionalism: each Alderman gets what he can for his ward, each Assemblyman for his corner of the state, each Congressman for his district, and each Senator for his state; and the outcome of such competition, when tested by voting, forms a fair sort of representative government, though an expensive and turbulent one. Similarly, trade journals may reflect and advocate as a matter of course the interests of the trade they represent, with no pretense of sympathy or understanding for the impinging trades.

When it comes to the mineral industry, we find associations of producers sometimes sharply in conflict with associations of consumers; or we find the interests of the producers of one mineral opposed to those of the producers of another, where the two are competitive for a market or for use. Such special-interest organizations are necessary and useful. Even organizations of national scope, if they frankly represent, let us say, the producing phase alone of the mineral industry, or the consumers or the importers' interests alone, regardless of the rest of the mineral industry, or of the country at large, are justified and worthy, so long as their field and attitude are clear to themselves and others.

In ascending the scale of responsibility, however, a stage is reached where partisanship and favoritism should be discarded in favor of a calmly judicial friendship to all. Such a stage, it seems to us, is occupied by the executive branch of our government, in all its forms; and in this group are included the bureaus representing the mining industry, the Bureau of Mines and the Geological Survey. What should be the policy of these bureaus? Should they support doctrines and measures which would benefit ten miners and injure a thousand farmers, and so conflict irremediably with the Agricultural Department, which, in its turn, would have the motto " We represent the farmer; the miner be damned"? We think not, as all are arms of the Chief Executive, who ideally is what the Indians call him, the Great Father in Washington; and so these mining bureaus will act as experts to further the prosperity of the mining and mineral industries, will be on watch as special "friends at court" to interpret, represent, and help them; but will do so in all fairness as regards other men.

In these vexing problems, there is no rule that works except the national one of the greatest good to the greatest number; and from this national point of view in the last analysis, a Federal bureau will not deviate. Where the interests of the mining and mineral industries, or any portion of them, conflict

with the average best interests of the whole country—East, West, North, and South—a branch of the Federal Executive will recommend to the rest of the Federal Government the solution which means the welfare of the majority.

Finally, to return to our own problem, what about the mining press—what about the Engineering and Mining Journal? The common-sense reply, it seems to us, depends on whether we represent a trade or a national publication. If the former, by all means boost—don't knock. It is also the easiest way. But the actual scope of the Journal, above partially sketched, is not only national but international. It seeks to cover (how inadequately we recognize with humility) all phases of an industry which in its entirety is not sectional, but is part of the very fibre of the nation's being and of the business and welfare of every citizen.

Iron and steel, copper, oil, lead, and zinc—these represent the foundations of prosperity of every state and group, and of the states united. We cannot see that it is possible consistently to assume partisanship for any part against the whole. Even in the most trying possible case, where a certain policy may appear to be for the benefit of the American mining industry as a whole, but opposed to the best interest of the country at large, we find no safe ground except in the rule of the greatest good to the greatest number. To favor groups or minorities at the expense of the rest of the country is to be unfair even to them; for whatever benefits the country at large is bound to react favorably on all groups, and be most to the advantage of every citizen.

The Conservation of Metals

SOME years ago, Gifford Pinchot, backed by Theodore Roosevelt, then President, launched a vigorous campaign in opposition to the popular impression that the resources of the United States were inexhaustible and indestructible. A trained forester, he focused his preaching on the reckless destruction of American forests (the heritage of centuries and the common dower of America—past, present, and future), for the enrichment of a few swift grabbers. He showed that unscientific and opportunistic forestry meant the destruction of the forests, irreparable washing away of the soils that had accumulated for thousands of years, and the trifling with local climatic conditions. The result of his campaign was the establishment of the Forestry Service, the withdrawal of Government forest reserves, and much other work that was good, even though it has not been far-reaching enough.

At the time of this forestry campaign, some attention was called to the advisability of conservation measures regarding our other natural resources, such as our minerals; but this phase was passed over lightly. Yet a forest of some useful varieties, like eucalyptus or white pine may grow from infancy to marketable age in a generation; but an orebody, once removed, is never renewed. Every pound of metal extracted from the earth leaves mankind in practical perpetuity that much the poorer.

The full consciousness of two things has only recently begun to dawn upon us—first, as to how immensely important to our modern civilization and to the strength and power of nations it is to have mineral wealth within our boundaries; and, second (through the more mature understanding of the geology of ore deposits) what are the relative and probable limits of metallic supplies in this country and in the world. Many nations are now enacting legislative measures to secure to themselves the maximum benefit from such mineral wealth as they have and enable them to "stake" all they can elsewhere in the earth before the world is all "located," to use the parlance of the prospector, to whose role the nations are turning.

Conservation measures of many countries, such as England, France, Spain, Mexico, and others, include a discrimination against aliens in favor of nationals, in order to prevent the benefits of their political control being superseded by a more powerful commercial control, and their mineral resources extracted to increase the wealth and power of foreign nations.

There is the stress of approaching necessity behind this movement. Already the competition for metals and metal-bearing districts has become keen among the great industrial nations; and, granted that our modern civilization is not quenched for all time by a bolshevist upheaval, we see clearly directly ahead of us an industrial era far more active than anything of which the world has ever dreamed. New peoples and new countries will demand the devices of modern mechanism, as a result of their own emulation and the missionary salesmanship zeal of the nations which are leaders in industry. Science and skill can cultivate renewed and even larger crops of many of the staple raw materials, such as textiles and foodstuffs; and even, to a degree, lumber; but progress of time and industry means a swiftly increasing shortage of mineral wealth. This would have visited the world long ago had any such intensively exploiting period ever before occurred in its history; and now that it has come, we must consider the results.

Doubtless most of us think that a serious shortage of metals is a matter too remote to affect us practically. It is true that the maximum effects will doubtless be considerably postponed. If, however, we look a thousand years ahead with the present rate of progress, we must picture a strange world, where many substitutes and devices have taken the place of the metals now prodigally used. Should the present rate of extraction be kept up, practically all our easily accessible and our higher-grade mineral wealth will have been used up long before this period, and mankind will either have had to give up the attempt, and have reverted to a simpler civilization, or will be extracting, at great cost, the elements from the rocks themselves.

Some metals, however, will be exhausted before others. Iron and coal will last a few centuries, and are abundant at present: other materials have a relatively long time to run; but in some things the

shortage is already upon us, and will increase swiftly. This is true, for example, of the precious metals gold, silver, and platinum, of various steel-hardening minerals, like tungsten, chromium, and vanadium; of radium and of tin. These metals are going the way of the auk, the aurochs, and the buffalo. It is estimated that the petroleum of the United States will be exhausted in ten to thirty years.

The war has brought home to the world the necessity of a wise nationalism: that the great states and races should hold themselves as separate units of the world league; otherwise the fusion of all would result in a mongrel mixture in which the benefits of evolution and the patient breeding of superior types would be lost. Therefore the great nations are casting about for measures to preserve their natural advantages, and increase them by adroit measures.

The "squeeze" of diminishing resources has not yet come to the United States as it has to the European nations, and therefore we have no national consciousness of one impending. We have for the moment the advantage of wealth, which we are squandering but which is still unsquandered, and we therefore estimate ourselves as a people with special gifts. It is the popular conception that we have only to develop our mineral industries like tungsten and chrome by protection, for these industries to be established on a policy of ever-increasing prosperity, and warnings of the geologist to the contrary are looked upon as "old wives' tales." Consider, however, the chrome industry of Maryland, which, in the earlier part of the nineteenth century, was the chief source of the world's supply: it is no longer producing. Already the gold deposits of Alaska are largely exhausted after twenty years of modern exploitation. Some metal deposits, like tin, we do not possess in commercial quantities at all; others, like tungsten and chrome, we have in so small a quantity that they would be exhausted in a few years of extraction, under the forced draft of prices artificially heightened by protection; others, like copper, we have been abundantly provided with, but we have already reached or passed the zenith of our metoric exploitation. In other words, the sapping of our national strength by prodigal consumption of our irreplaceable limited stocks of metal is not a matter of a thousand years hence, but of the present generation, and still more intensely of the next. We are passing to our sons to bear the debts the United States has incurred in this war. Is it fair for us to squander their patrimony and not leave them as well provided as possible with the means wherewith to pay? Is it generous for a few of us to howl for sudden wealth through feverishly robbing the earth of the fruits of all time; and to have the wealth made possible by forcing an abnormal market on the rest of the people through special legislation? Certainly it is not for the best interests of the country. We may not expect the Republic to last forever, but we have inherited the results of our forefathers' work, and our duty, at the least estimate, is to hand on the Republic unplundered and unsapped to our sons. When our own stores are gone, we shall have more difficulty than now in getting them elsewhere, for other nations are waking earlier than we to these fundamental facts; and the principle of export duties and other discriminatory legislation in order to further conservation and to give the national possessors of wealth economic advantage, is coming to be more commonly employed. For the immediate present, let us conserve the stores of our own "cache" prudently, and eke out by buying where we can most cheaply. We shall not always have the opportunity.

The Downtrodden Capitalist

A capitalist, says our good friend the dictionary, in effect, is one who has accumulated goods, which he uses to promote the production of more goods, rather than for his immediate enjoyment. Most of us are capitalists—all but the unfortunate and the unfit. The owner of a prospect, a mine, a share of mining stock, or a Liberty Bond, a farm, a taxi, a fishing sloop, or a sawmill, is a capitalist. A country is strong and steady in proportion to its amount of capitalism. In France, we are informed, nearly every one is a capitalist. In the United States, there are fewer capitalists, perhaps, than in France, because more, even of the prosperous, live from hand to mouth. The man with an automobile and a mortgaged home is not, perhaps, a capitalist, but the plumber who holds the mortgage is one. Let every one who does not belong to the capitalistic class start a savings-bank account, and become a capitalist.

Is the above far-fetched or humorous? Not in the least. The working capital of the country is mainly held by the population at large, who have invested their savings in Liberty Bonds, railroads, public utilities, mortgages, and savings banks. And having invested his savings in railroads or public utilities or other ordinary forms of investment all necessary for the country's progress—having loaned his accumulated overtime labor and self-denying thrift to the public in response to its urgent solicitations and demands,—the individual with the formidable designation of "capitalist" becomes the most helpless lamb imaginable. He has no rights nor friends. When not only his income from capital but the capital itself is wiped out by the great forces of the day, he seldom has courage even to expostulate. He is outside the law. He is the prey of the wage-earner on the one hand and the organizer on the other. The former, spending as he works, has prior claim on all available moneys so long as there are any; and the latter has many devices to assure of not being overlooked in the division. If worst comes to worst, he reorganizes the enterprise in question, and there is enough left for the wage-earner and himself; but the capitalist finds himself thrown out into the street. Possibly he deserves no better, for he is not greatly gifted with sense; he is usually a strong partisan of the wage-earner (whom he calls the "laborer") and hostile to the organizer (whom he calls the "capitalist"). He loves what he conceives to be

the under dog, as a result of the atmosphere of fanciful economic folk-lore in which we live; and when he is sandbagged and robbed by both the maiden and the dragon, he is so ashamed to think that he had secreted a private fund that he will not go to the police with the story, but starts another surreptitious hoard out of his $36 or $72 per week.

The organizer is a most useful citizen. He is a great producer, who deserves a far higher share in the division of the profits than the rest of us. Our problem for the future is to decide how much he shall have, and that he does not take too much. The virile organizer has sometimes spells of berserk madness; he reverts temporarily to his viking ancestors and cannot help trying to pirate the whole. Our other problem is to see that the wage-earner (honest laborer) does not take it all, for he is not gifted with imagination and would gladly take it all, and more—he needs it.

Know then, honest miner, mining engineer, or holder of mining stock, that the quaint division into capital and labor, if it ever applied accurately anywhere, does not do so here and now. The average and the ideal American is both capitalist and laborer; he works, and produces, and he has, by overtime work or the expenditure of excess energy, saved something to make his old age dignified. About one in ten, perhaps, of such average Americans is also an organizer to a greater or less degree. The organizer, again, may or may not be a capitalist; but if he is not one, he hopes so to become. They are all indispensable professions; and a proper division of the rewards will not ignore the rights of any—least of all the members of the unorganized capitalistic class who can now only compensate their losses by the fact that they are also laborers. If they are past labor—and there are many of them—then may God console the aged or broken-down capitalist and wage-earner or his widow, for the law does not provide against his robbery by the other two active parties.

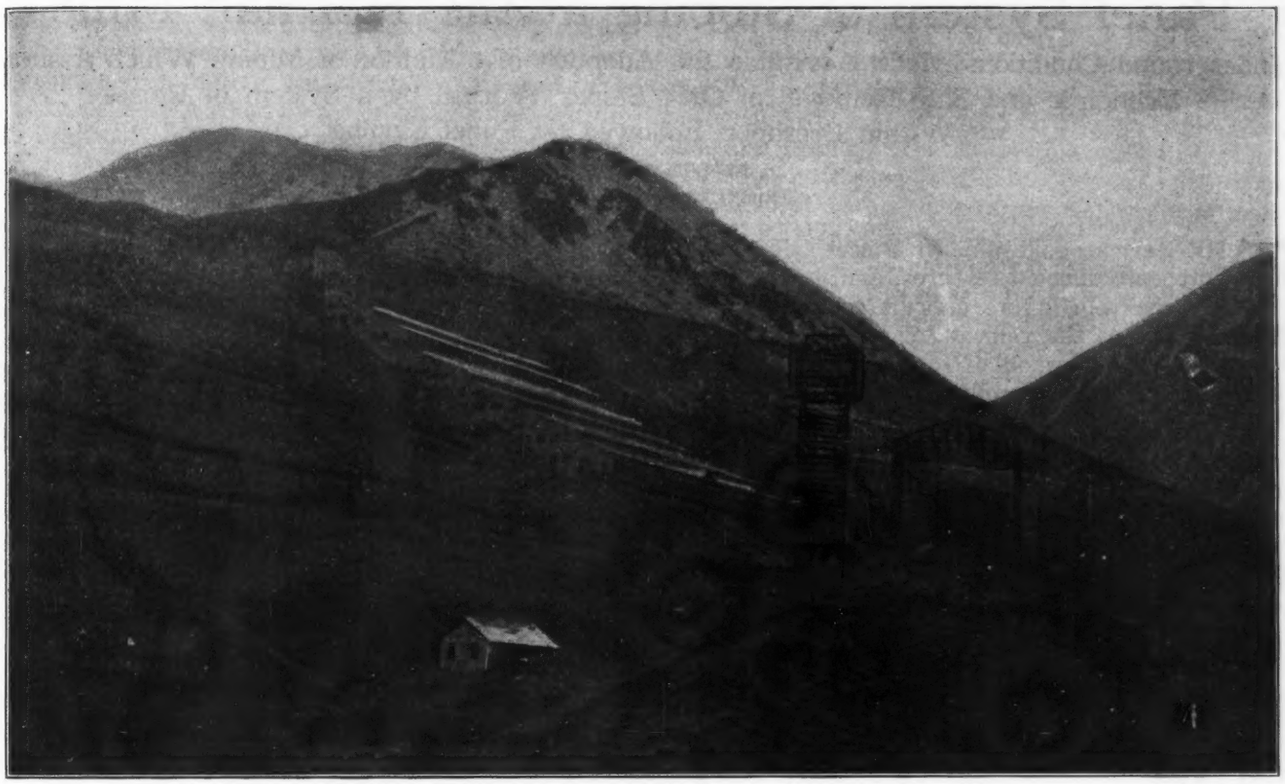
Gasoline Locomotives Underground

IN THE November Bulletin of the American Institute of Mining and Metallurgical Engineers, F. J. De Wilde contributed an interesting discussion of the paper on "The Wisconsin Zinc District," by W. F. Boericke and T. H. Garnett. From this discussion we quote the following paragraph:

"Haulage—It seems to me that the gasoline and storage-battery locomotives have been slighted by the authors and favoritism shown to the mule. The authors state that haulage costs when using mules are from 25c. to 35c. per ton-mile. This is excessively high when compared to mechanical haulage, where the cost is seldom above 24c. per ton-mile with a limited tonnage. Where large tonnages are hauled, the average is about 16c. per ton-mile. When first used, the cost has been as low as 8c. per ton-mile. These figures include the cost of maintenance, repairs, oil, gasoline, and depreciation. The exhaust from gasoline locomotives vitiates the air considerably and it always takes some time for the men to become accustomed to the fumes. The mines must be kept well ventilated for good results."

The methods of underground haulage, the burden of the paragraph quoted, are given as, mule, gasoline locomotive, and storage-battery locomotive. Concerning the mule and storage-battery locomotive there need be little discussion, as both methods are safe insofar as underground conditions are concerned, and the selection of either is dependent upon comparative costs of installation and operation in specific cases. The writer's statement of the vitiation of the air by the exhaust from the gasoline engine, and that it always takes some time for the men to become accustomed to the fumes, should make mining engineers sit up and raise the question whether men can ever become accustomed to the "fumes." The poisonous constituent of the "fumes" is carbon monoxide. Viewed from a physiological standpoint it is a matter of doubt whether the human system can accustom itself to the continual presence of even a small percentage of this noxious gas in the air of a mine. In justice to Mr. De Wilde, it should be noted that he states that the mine must be kept well ventilated to secure "good results."

The use of the gasoline locomotive underground at all is objected to by many well-qualified engineers. The Bureau of Mines advocates the elimination of internal-combustion locomotives from underground workings. A similar position is taken by some states in their safety regulations. The prevailing use of the internal-combustion engines for many purposes raises the question as to whether this position is not a reflection on the ability of engineers to overcome a difficulty which imposes such restrictions upon the use of gasoline locomotives underground. We do not know of any recent work done upon the gasoline locomotive with the objective of rendering the exhaust gases innocuous; but we believe that experimental investigation should be pushed, and the question of the practicability of the gasoline locomotive underground determined on more substantial grounds than at present exist. Whether the difficulty lies in the carburetor, or in a change in compression, or in the proper selection of lubricants, are points which should be cleared up. There are few absorbents of carbon monoxide, and probably none is practical. It appears to us that the design of the engine, the perfection of a suitable carburetor, and the standardization of the operating details of the engine are the significant features that might lead to the development of an engine unit that could be satisfactorily used underground. Until this is done there will be the temptation to use the existing gasoline locomotive underground, and though its use may be restricted to those parts of a mine where there is good ventilation, occasions may arise where portions of the mine might become charged with dangerous amounts of monoxide in quantities greater than even "men accustomed to the fumes" can safely inhale. It seems to us that the investigating already done by the Bureau of Mines might well be extended and pushed to early completion.



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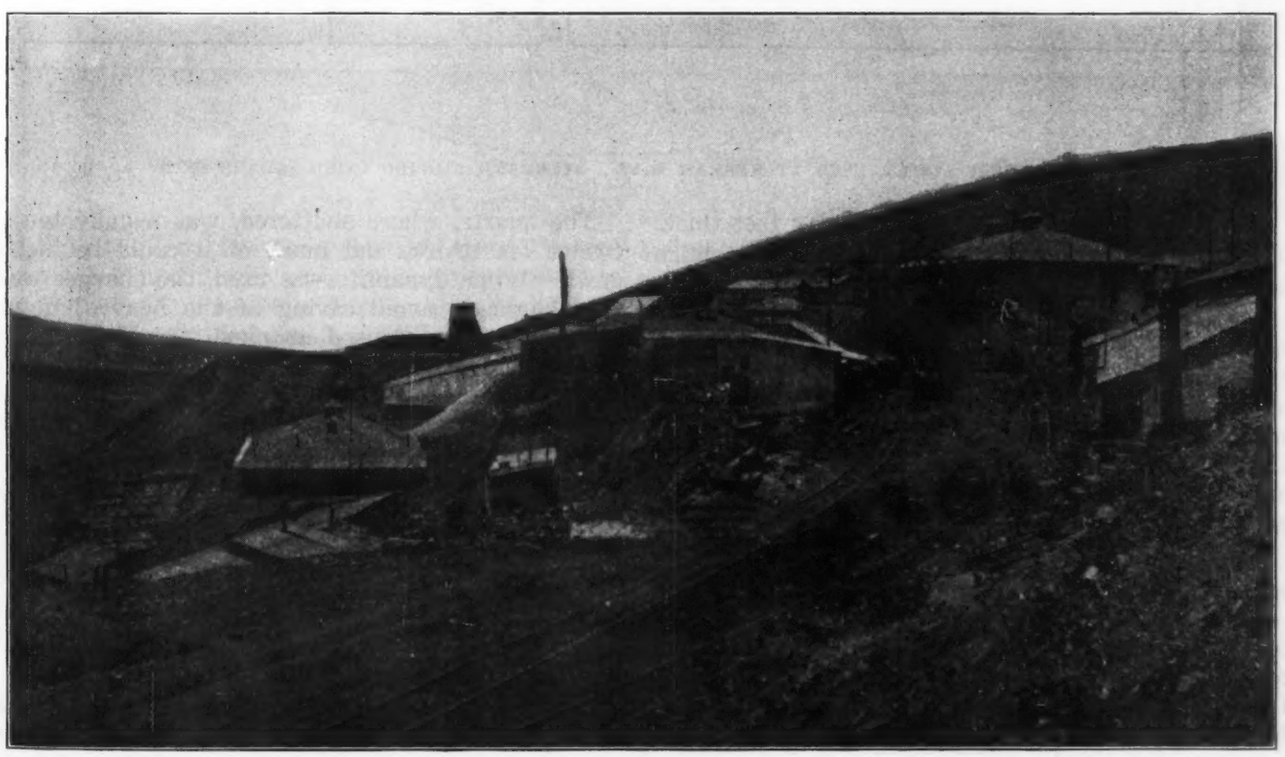


Panel System of Stoping at the Herman Mine

Underground Conditions Made Advisable the Adoption of a Method of Mining Which Assured Economic and Safe Removal of Ore—Stopes Worked by a System of Raises Within Oreshoot, Followed by Panel Stoping

BY S. H. BROCKUNIER
Mining Engineer, Lowell, Mass.

THE Herman gold mine, in Placer County, Cal., presents unusual features, and, in the mining of the vein, offers difficult conditions. This article describes the vein and the manner in which an unprofitable method of stoping was changed a few years ago into a profitable one.

The Herman vein consists of quartz, lying wholly within schist walls. This schist is blocky and has many cross fractures. On the hanging wall there is a layer of soft black slate, making the upper part heavy and subject to many falls without warning. This is especially true if a large surface is exposed to the air for any length of time.

to four inches in diameter and sometimes twelve inches long. Some of them were clear quartz and some stained from the iron in the vein, producing different shades of amber and brown. Contrary to the usual rule, the gold content increased in or near these watercourses, so that often the mill would be stamping rock crystal and recovering gold. Surrounding the courses the vein was usually shattered; the quartz could be dug out by hand and resembled dirty rock salt. The greatest gold value was found in these places, and depth may prove that the pockets result from a mechanical sorting and concentration of the gold from the vein above.

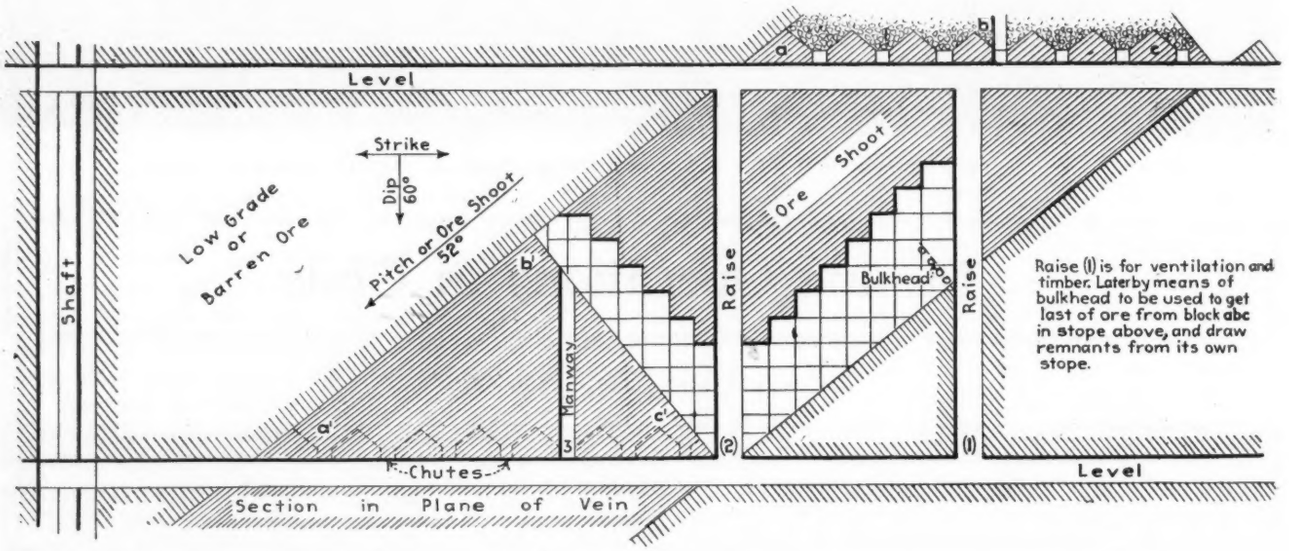

Level
Strike
Dip 60°
Low Grade or Barren Ore
Pitch or Ore Shoot 52°
Shaft
Raise
Ore Shoot
Bulkhead
Raise
Raise (1) is for ventilation and timber. Later by means of bulkhead to be used to get last of ore from block abc in stope above, and draw remnants from its own stope.
Manway
Chutes
Level
Section in Plane of Vein

FIG. 1. FIRST SYSTEM USED AT HERMAN MINE. OVERHAND STOPING USING SQUARE SETS

The quartz vein is from four to thirty feet thick. The gold is confined almost entirely to shoots, which are generally in the thickest part of the vein. Usually the value decreases without any change in the thickness, although there is a physical change, which the trained eye can detect, as the quartz becomes denser and more glassy as the value decreases. There are many high-grade spots in the shoot, but as a whole the ore is a low-grade, and all the methods of mining and milling were consequently governed by that circumstance.

The quartz in the principal oreshoot was unusually abrasive to tools and mill, but was brittle and easily broken. It contained numerous water courses, some of which occurred at a depth of 1,000 ft. below the outcrop and formed caverns or holes six or eight feet in diameter. These caverns were lined with beautiful quartz crystals from a fraction of an inch

The quartz, where shattered, was usually ten or twelve feet thick, and much of it could be picked down. When dynamite was used, the charges were made light to avoid caving of the heavy hanging wall, which had caused so much trouble that the previous practice had been to open the shoot by raises from the level below and then extract the ore by overhand stoping, timbering closely with heavy square set timbers. (See Fig. 1.)

This method worked satisfactory in that the hanging wall was supported during the progress of the work but the practice was dangerous and entirely too slow and expensive, considering the grade of ore obtained, and at least one of the raises was in waste all of the time, and therefore was an additional expense, with no return.

After considerable experimenting it was found that the hanging wall in these stopes would stand

well, without timber, up to twenty feet of open space, providing that a little quartz was left on the hanging and the opening was given an arched roof. The method of mining was therefore changed, and the stopes were worked by a system of raises within the oreshoot, followed by stoping in panels across the shoot (see Fig. 2), using only an occasional stull to catch up a loose piece of ground, or as a support for the drillers where the dip was steep. If the work was too slow there were occasional falls of large blocks, and these had to be worked out, and were used to fill the lower stopes.

One hundred and fifty feet between levels proved to be the proper distance for synchronized work of the miners in a shoot 200 ft. long and from eight to twelve feet thick. Two drillers were started in raises No. 1 and No. 2, and one driller worked in raise No. 3, all on the foot-wall side of the vein. Raises No. 1 and 2 were 8 x 12 ft. and raise No. 3 was 6 x 8 ft., hence the footage to be made in each was the same, and No. 2 and No. 3 intersected at the same time that No. 1 reached No. 4. The driller in No. 3 then turned with the oreshoot and continued to the upper level. His raise was used for a manway and for ventilation, and was necessary to this manner of working. The drillers from No. 2 then moved to No. 4 and drove that raise, while the drillers in No. 1 continued to the level above. The drillers from raises No. 1 and No. 4 were then changed into the panel stopes 5 and 6, and two other drillers put in 7. When half way up the drillers sometimes broke through the pillars on either side in order to get air and timbers more readily, and to permit leaving broken ore in the stopes below.

The temporary manway into No. 2 was necessary in the beginning to permit entrance to stopes after blasting when chutes No. 1 and 2 were filled with ore. When the driller in No. 3 made connection with the upper level he came back to the lower level and made the openings for chutes on each side of his own raise, as shown at a, b, c. These chutes were used in stoping the block of ore a-b-c by the usual method, leaving pillars to support the hanging.

After the stopes were fully opened, the pillars on both sides of the panel stopes were sliced down and finally cut through, leaving the small pillars shown by reverse cross-hatching. These pillars were drilled at this time and were shot down as the ore was drawn in the stope. The pillars in the level above were also drawn at this time, allowing the caved waste and mat from the stope above to rest on the top pillars and follow them down when they were drawn last. Of course, if the level was to be retained for haulage or access, it was necessary to leave these pillars until later or to replace them by timbers. The thickness of the pillars depended upon the nature of the ground, although they were kept as narrow as was consistent with safety.

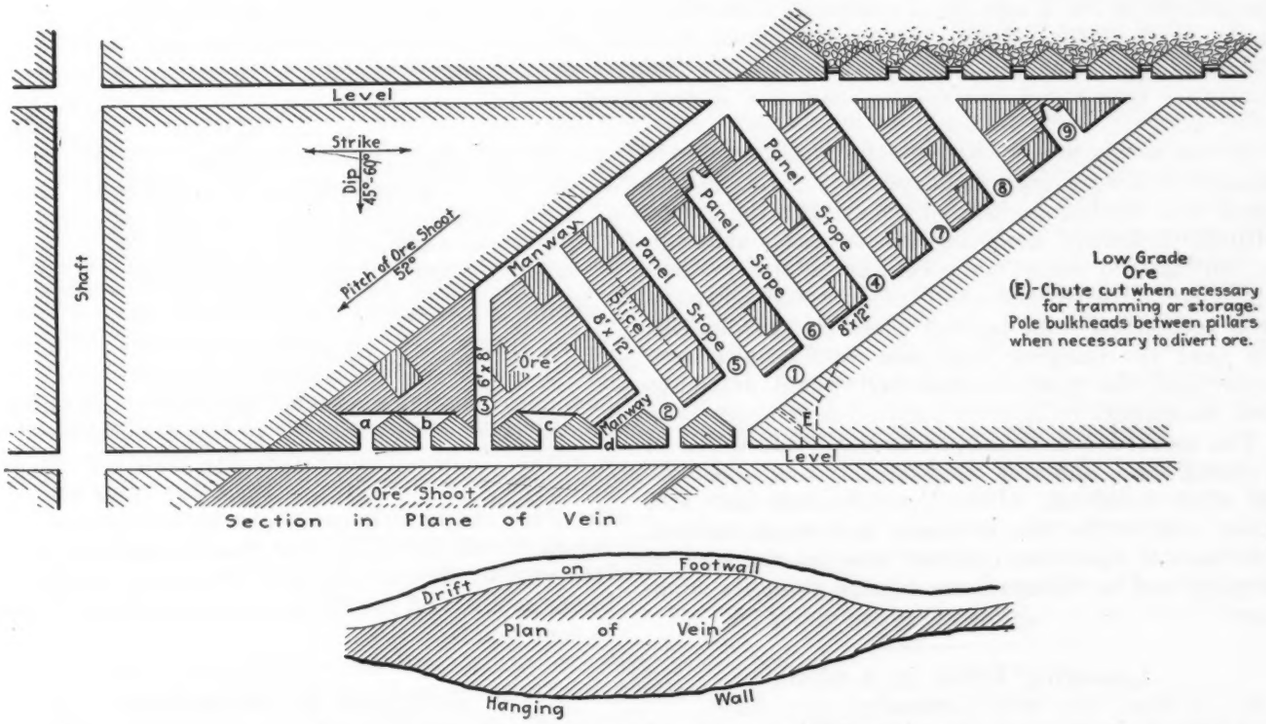


FIG. 2. PANEL SYSTEM LATER USED AT THE HERMAN MINE

The disadvantages of the method were that it threw the bulk of the ore into two or three chutes, thus making it more difficult to get speedy tramming, but this was also true of the old method; and there was little opportunity for storage of ore, as the stopes were worked practically open, the only storage being in the lower part. The method would, therefore, be inapplicable excepting in cases where ore was to be removed quickly. Shrinkage stoping had not worked well on large areas, as the hanging crushed down and pinched the broken ore.

The advantages of this method were as follows: Speed in opening the stope, which was vital in order to prevent large areas from being exposed to the slacking influences of the air; little timber used; no ladder ways excepting in the bottom of No. 3 raise; practically no mucking in stopes, unless the vein became very flat; the miners at all times working under a cover, and several men were always working in proximity and could help each other in case of trouble, although having their own places of working out of sight of each other. All of the development was in profitable ore the entire time, doing away with handling of waste, and all raises, excepting No. 3, were large enough and pulled enough ore to be classed as stopes.

The miner in raise No. 3 pulled 15 to 20 tons per shift, the miners in Nos. 1, 2, and succeeding numbers, pulled 40 to 50 tons per shift per raise, and the pockets in No. 1 and No. 2 chutes had therefore to be made large enough to accommodate that amount of ore and yet allow access through the temporary manway d, while No. 1 and No. 2 were being driven.

Of course the presence of unusual quartz made it possible to secure such tonnages in the raises, and speed was further facilitated by driving the raises without timbering, excepting for an occasional stull. In harder and more compact quartz the method would not have worked—that is, it would not have been economical—but in that case the probabilities are that the hanging wall also would have been better and the practice described would not have been necessary.

The method was developed to meet difficulties in a special case, and was used on only one oreshoot; the other oreshoot, where the vein was four feet thick, worked by the ordinary shrinkage method. The plan of operation outlined lessened the cost of stoping, and no miners were injured after its adoption.

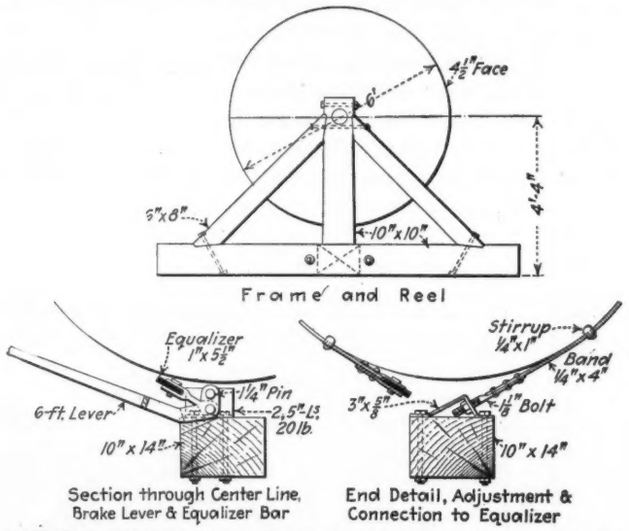
Lowering Cable in a Shaft

BY H. F. MILLS

At the Loretto mine, Loretto, Mich., a No. 0 B. & S. 3-conductor, 5,000-v., armored cable weighing 7,800 lb. was recently lowered in an 800-ft. vertical shaft by means of a hand brake, using the original reel.

It is common practice to lower the reel to the desired depth and then pull the cable up by means of the hoisting rope, but that method could not be used in this instance, as the reel was too large to pass through the shaft. Another method which is sometimes used—that of lashing the cable and the hoisting rope together at intervals and lowering by the mine hoist—was discarded on account of the difficulty of lashing to the ½-in. x 4-in. flat hoisting rope, and because of the danger of the ropes spreading and straddling a pipe tee, or other projection, as the ladderway is small and much of the space is filled with pipes and cables.

A substantial wooden frame was built to accommodate the reel. Two brake bands, as shown in the accompanying sketch, were mounted, one on each side of the reel, the bands being provided with a number of U-shaped clips to prevent their slipping off the reel. One end of each band was provided with a screw tension adjustment, the other ends being connected to the opposite ends of an equalizer bar. This bar was, at its center, connected to the forked end of the brake lever by a short arm. This arrangement relieved the reel of most of the twist which would result from the use of one band.



DETAILS OF APPARATUS USED TO LOWER CABLE IN SHAFT

The frame and reel were set over the ladderway, and the cable was lowered to the 800-ft. level. Two men on a hoisting cage kept abreast of the end and guided it when necessary. It was then secured by a heavy timber clamp below the 500-ft. level, and again lowered, the bight in the cable being pulled in the shaft station where a tap was to be made. The remainder of the cable was then secured at 150-ft. intervals by timber clamps. One man handled the brake easily, and the cable was lowered and in place in four hours.

Petroleum in Switzerland

Interesting information as to the oil-bearing properties of the Swiss soil is contained in a work entitled "Investigations on the Petroliferous Molasse in Switzerland," by Arnold Heim and Adolf Hartmann, which has just been published, says the "Financial Times," London, Oct. 31, 1919. In the introduction the authors make the following statement, which indicates that there may be great possibilities of development if the requisite enterprise can be found in Switzerland for developing this new line of mineral production: "In general it is little known that rich oil-bearing shale is common in Switzerland, particularly in the Canton of Geneva, where hundreds of thousands of tons of lubricating oils of the best quality are lying in the ground, besides benzine and burning petroleum. If we can solve the problem of developing these resources in a rational manner our country will in future be fully provided for in the matter of the raw products of the petroleum industry."

Ore Contracts—Part II.*

An Ideal Ore Schedule Should Provide Equitable Payment for the Desirable Contents of All Ores and a Distribution of Profit Calculated to Cause Maximum Economical Development

BY C. A. GRABILL

THE schedule is simply a statement of the method of ascertaining the payment to be made for the desirable substance in the ore and the deduction for the undesirable ones, with the charges for treatment. An ideal schedule may be defined as one that is applicable to all ores, that will provide payment for all the desirable contents proportional to the value to the buyer of the respective amounts recoverable or usable, and for deductions for the undesirable contents proportional to the harm caused, and for a treatment charge in accordance with the work to be done and the expenses incurred in reduction, refining, and delivery, but with the quantities so adjusted as to yield the minimum profit to the buyer on ores of low grade or high cost of production in periods of low prices, and the maximum on high-grade or cheaply mined ores in times of high prices, the actual profit to the buyer in each case to be such as to cause the greatest development of the seller's property economically possible, and therefore the maximum possible profit to buyer and seller combined.

Of course, it is not possible to evolve such a contract, but with the simple omission of the last three words and the word "therefore" the above long sentence represents the aim of most ore contracts.

The substances usually covered are gold, silver, copper, lead, iron, lime, silica (insoluble), zinc, arsenic, bismuth, antimony, and sulphur, to which is added a treatment charge. They will be considered in this order.

Gold

The value of pure gold at the mint (mintage value), is a fraction of a cent more than $20.67 per oz. Troy (England, £4 4s. 11.45d. per fine oz. Troy). This is equivalent to about 66.5c. per gram in metric measure. This is not necessarily the available value. In Mexico, for example, there are extraction or other taxes that may amount to 10 per cent of the value, and there is or was until recently a provision which was practically an embargo on export of gold. The result was that the effective value of the fine gold to the owner was governed largely by the rate of exchange between Mexico City and some foreign point, mainly New York City. This applied not only to foreigners doing business in the country but to the natives who had to purchase large amounts of their supplies from foreign sources.

Ore contracts usually specify that if there is more than .05 oz. per ton of gold in the ore all will be paid for at $20 per oz. This is sometimes made $19 or $19.50, but $20 is the usual amount. The smelting company must pay for refining and delivery and mint charges, so it is obvious that it is not going to make much from low-grade ores on this item. It also has to assume a positive loss in the slag. In spite of this slag-loss, books on smelting state that the recovery of gold is usually 100 per cent or more, and it is commonly accepted that this is due to small amounts in ores too low grade to pay for determination or consideration. The truth is that the average smelter has a pretty fair idea as to the source of the gold in his shipments and the 100 per cent recovery. The protective factor is the cupellation loss. In buttons of large size this is very small, amounting to only a fraction of 1 per cent, but most smelting charges contain comparatively small amounts, and the cupellation loss increases (stated in per cent, not absolute units) quite rapidly as the size of the button decreases. I have not the exact figures at hand, but as I recall them the loss is of the order of 10 per cent on a copper ore containing $1 per ton in gold. At any rate, the smelter gains on this item are not of great importance, because as soon as the amount on the charge becomes appreciable its slag losses increase and the protective cupellation losses decrease. The presence of gold may therefore be considered to have no effect on the balance of the schedule.

At $20 per oz., .05 oz. Au is $1. On small shipments the cost of assaying by both parties and a possible umpire will not leave much of the $1 to worry about. If there is, say, $0.50 Au in the ore, it is usually considered in making the other terms. In large shipments the limit is often lowered.

Silver

New York prices for silver are based on the fine ounce, Troy, but London prices are quoted in pence per Troy ounce of standard silver, 925 fine. Formerly the London price was the governing price, but since the war the New York price is the base, the London price varying from the other in accordance with the cost of delivery and the exchange.

The schedules usually provide for the payment of 95 per cent at the New York price if the ore contains 1 oz. or more per ton. Sometimes the figure is as low as 90 per cent and rarely as high as 100 per cent, but in the large majority of cases it is 95 per cent. All treatises on smelting place the silver loss at about 5 per cent and as due to two causes, namely, silver in the slag and silver volatilized in the fume.

In a modern plant there is a baghouse or Cottrell plant, and in such cases the volatilization losses may be assumed at zero. There is a dusting loss on all ores which, though undetermined and perhaps amounting to fairly large figures in the aggregate,

*Part I was published in the "Engineering and Mining Journal" of November 22 and 29, 1919.

is quite small on the percentage basis, a small fraction of 1 per cent in a good plant, I should say, and is partly covered by the 1 per cent minimum moisture clause. As a matter of fact, the 1 per cent minimum is usually exceeded except in dry climates like Arizona, and even there most ores have some moisture.

The slag remains, then, as the only important source of loss. The only questions consequently are: does 5 per cent represent the general condition, that is, is it too high or too low; and is the percentage basis correct or should there be a fixed deduction of, say, 1 oz. per ton and 100 per cent of the remainder paid?

C. H. Fulton (Bureau of Mines, Technical Paper 83) as quoted in the report of the Colorado Commission estimates the silver losses in copper smelting at from .5 to 10 per cent, and in lead smelting from a loss of 1.5 per cent to a gain of 1.75 per cent. Although stated in this form, he really means that in lead smelting the recovery is from 98.5 to 101.75 per cent of the assay value of the ores treated, or such is my interpretation of the statement, and in copper smelting it is from 90 to 99.5 per cent.

There is little accurate published data. The big custom smelters do not care to publish theirs, for obvious reasons, and the private plants, where silver is usually a comparatively small part of the values, rarely keep records that are sufficiently accurate. I am inclined to think that 5 per cent is an underestimate of the loss and 95 per cent an underestimate of the recovery. The discrepancy is due to the difference between the actual silver contents of the ore and the assay, as commonly reported, caused by cupellation and kindred losses in assaying.

The general opinion is that these are small, perhaps 1 per cent. This belief is due largely to the fact that experiments in this line have been made mostly in connection with bullion work or on high-grade ores, on which the loss is low. Fulton states, in his work on assaying that the silver recovered in a "corrected" assay is from 98 to 100 per cent of the amount present, but it is not common to make corrected assays in mine, mill, or smelter work. By "corrected" assay he means the determination of the silver absorbed by the cupel or scorifier slag and its addition to the regular result. Sharwood states (Bulletin of the A. I. M. E., Vol. LII, page 129) that the percentage loss in cupellation is inversely as the cube root of the weight of the button, and for silver is 1 per cent for a 1,000 mg. button and 10 per cent for a 1 mg. button. In the scorification assay it is customary to take a charge of from .2 to .3 A.T. On a .25 A.T. charge a 1 mg. button would mean an ore with 4 oz. Ag per ton. Fulton gives a series of tables showing that the additional loss in assay slag is from .14 to 3.0 per cent and that the cupellation loss in the ordinary assay is materially increased by the presence of Fe, Sb, Sn, As, Se, Te, and Zn, and gives a table showing that the addition of 1 gm. of Te to the cupel caused a loss of 65 per cent, approximately.

The Colorado report gives the average of all ores smelted in that state for four years as 18.5 oz. Ag per ton. That would mean on a crucible charge with a .5 A.T. charge a button weighing 9.25 mg.

Sharwood's figures would indicate a 4.75 per cent cupellation loss, to which should be added an increased amount for loss in the assay slag and increase due to impurities or perhaps 6 per cent as the total assay loss. In other words the smelter has 6 per cent unreported silver in the ores which will readily explain Fulton's figures of 98.5 to 101.75 per cent recovery, in spite of the known silver in the slag.

If Sharwood's figures are correct (and there is no reason to doubt them), a plant operating with 4 oz. per ton will have about 12 per cent unreported silver, and if it reports a 5 per cent loss the real loss is around 17 per cent.

Of course a difference of 15 per cent on a 1 oz. charge means only 16c. per ton, even at present prices, and on small lots would not pay for the extra cost of determining it. This also accounts, in a measure, for the failure to pay for small amounts of silver, say when it is less than 1 oz. If known that the average will be around .5 oz. per ton, compensation may be made in a slight decrease in the treatment charge, with better monetary result to both parties.

All of which brings up the question as to what the actual loss in the slag is, and what the laws are that governs it. Discussion of it would lead too far, but there is one point that is interesting. The silver in the slag is always some function of the silver in the collector, though in lead smelting the presence of more than one collector complicates matters. In copper smelting, within the ordinary limits the relationship may be represented by a straight line. In cases where this condition is not obscured by some other factor it is interesting to note that the percentage loss of silver has nothing to do with the amount on the charge. This may be demonstrated as follows:

For convenience let the relationship be represented by the factor K, and assume that the collector is copper matte, then

$$\text{Oz. Ag in the slag} = \frac{\text{Oz. Ag in charge} \times K}{\text{Wt. of Cu matte produced}}$$

Dividing both terms by the number of ounces of silver on the charge, and noting that the left-hand term is then the silver loss expressed decimally, and multiplying both terms by 100, so that the figure will read in per cent, we have:

$$\text{Silver loss in per cent} = \frac{100\ K}{\text{Wt. of Cu matte produced}}$$

The whole matter is complicated, and many other factors appear that may interfere with the application of this rule, but where it does express the condition it means that the percentage loss is dependent on the amount of collector available, other things being equal and is independent of the amount of silver on the charge.

The 95 per cent payment clause originated in Colorado, and it is interesting to note that in that state

the smelting companies have to import lead ores at some expense, and consequently all companies try to operate on a minimum of collector that is more or less the same, and the conditions tend to be the same. O. R. Whitaker, in his report of the Colorado Commission, assumes a constant loss of 1 oz. per ton of ore, and calculates the percentage loss against this for the different grades of ore, but I do not believe he was justified in so doing.

It is obvious also that a dry ore containing no collector might displace some of the collector already on the charge, and thus be at a disadvantage in comparison with one carrying copper or lead, in sufficient amount. The subject is too big for discussion here.

Lead

Copper smelters do not pay for the lead in ore received by them, because it is not normally recovered by them, and, when it is, by the aid of a baghouse Cottrell plant or otherwise, the cost of recovery is about the value of the product. Part of the lead on the charge of the copper blast furnace goes in the slag, part in the matte, and about half into the fume, and that in the matte goes to the converters, from which it emerges as fume. The time is approaching when this fume will be treated to recover the lead, arsenic, antimony, and bismuth at a profit, but they are not yet considered as assets.

Wet methods only should be used for the determination of lead. The dry assay is easy, but usually low, though not always so, because arsenic, antimony, bismuth, and zinc may raise the weight of the button above the percentage as determined by wet assay. When the dry assay is used in the schedule it should be made by running a wet assay and deducting an agreed upon figure, from ¾ to 2.0 units as the case may be, calling the results the dry lead.

Small amounts are not paid for even at lead plants, or are paid for at a very reduced rate, but the reason is not the same as with silver and gold. Lead furnaces require at least 8 per cent on the charge for satisfactory work. If the ore contains less than this, the difference must be made up by the addition of richer ores, sometimes, notably in Colorado, obtained at considerable expense. Furthermore, the lead loss is largely a fixed amount, independent of the amount on the charge (unlike silver, where it is the percentage loss that is independent of the quantity) and consequently the percentage loss increases as the assay decreases. Ores without lead are penalized by a higher treatment charge in lead practice. When they are siliceous and low in lead, they may be sent to the copper furnaces if such are available and the lead lost rather than incur the extra expense of furnishing the extra lead for them.

Originally there were large losses of lead in the fume by volatilization, but the introduction of baghouse and Cottrell is eliminating this and the lead in the slag will soon be the only serious loss. Mr. Whitaker gives the loss in Colorado practice at about 30 lb. per ton of ore; this probably is intended to include losses by volatilization in plants not equipped with baghouses. In another place he says that with low-grade ores 10 per cent goes into the slag, and Fulton, as quoted in the report, states the total loss as from 5 to 20 per cent.

Smelter Investigation Committee

State of Colorado

The schedule is as follows:

Gold: $19.50 per oz. if 5/100 oz. or over per ton.

Silver: 95 per cent of New York quotation, date of assay.

Lead: Prices based upon $4.00.

Wet assay, 1.50 units off wet assay for dry assay.

Copper: Deduct one unit from wet determination for dry assay, and pay for dry copper on casting quotation for copper; defined as the electrolytic cathode quotation, as given by the "Engineering and Mining Journal" for the week preceding date of assay, less 3-10th of a cent per lb., with the following deduction:

Six cents per lb. from above quotation.

Zinc: Limit 10 per cent; 50c. penalty for all excess per unit.

NEUTRAL SCHEDULE

	5%	to	10%	lead	incl.	40c.	per	unit;	$5.00	treatment
Over	10	"	15	"	"	43	"	"	4.00	"
"	15	"	20	"	"	45	"	"	3.00	"
"	20	"	25	"	"	47	"	"	2.00	"
"	25	"	30	"	"	49	"	"	2.00	"
"	30	"	35	"	"	51	"	"	1.00	"
"	35	"	40	"	"	52	"	"	.50	"
"	40	"	45	"	"	52	"	"	.00	"
"	45	"	50	"	"	53	"	"	.00	"
"	50	"	55	"	"	54	"	"	.00	"
"	55			"	"	55	"	"	.00	"

Neutral basis, 10c. up or down.

FLAT SCHEDULE

	5%	to	10%	lead	incl.	40c.	per	unit	$7.50	treatment
Over	10	"	15	"	"	43	"	"	6.00	"
"	15	"	20	"	"	45	"	"	5.00	"
"	20	"	25	"	"	47	"	"	4.50	"
"	25	"	30	"	"	49	"	"	3.50	"
"	30	"	35	"	"	51	"	"	2.50	"
"	35	"	40	"	"	52	"	"	1.00	"
"	40	"	45	"	"	52	"	"	.00	"
"	45	"	50	"	"	53	"	"	.00	"
"	50	"	55	"	"	54	"	"	.00	"
"	55			"	"	55	"	"	.00	"

"Neutral Schedule" to be used when it figures better for shipper.

SILVER QUOTATION

The New York quotation for bar silver, as furnished by Handy & Harman, or their successors in business (or, in case said firm and its successors should go out of existence, by the firm of J. W. Seligman & Co.) to the Western Union Telegraph Co. on date of assay.

LEAD QUOTATION

The prices paid per unit for lead in all ores and concentrates are based upon a quotation of $4.00 per hundred lb., 1c. up or down for each change of 5c. in this quotation.

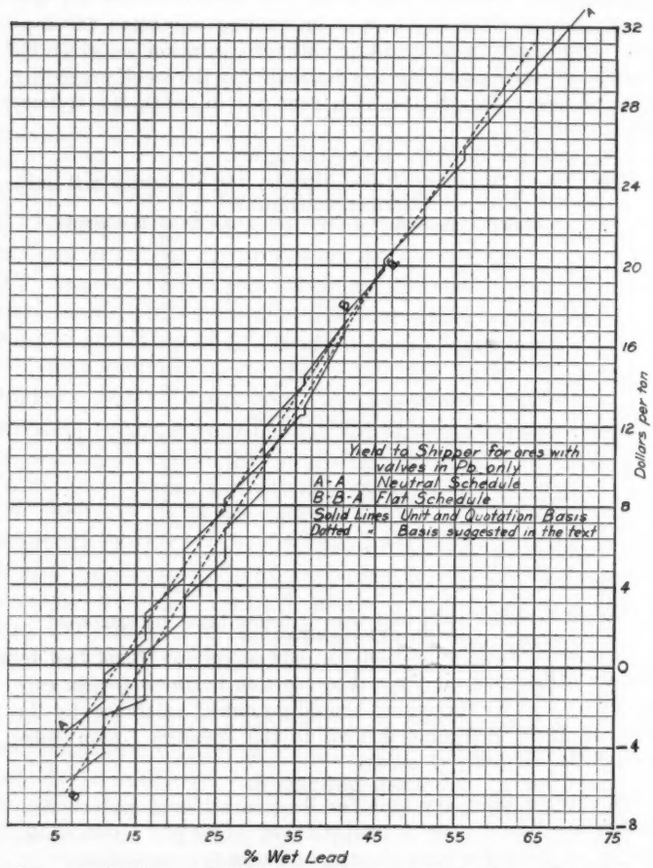
The quotation used as a basis of settlement shall be 90 per cent of the sales price in New York of the American S. & R. Co. of common, desilverized, domestic lead, in lots of fifty tons or over, for delivery within thirty days, on date of assay; provided said sales price does not exceed $4.00 per hundred lb. When it does exceed $4.00 per hundred lb., the quotation used as a basis of settlement shall be $3.60 per hundred lb., plus ¾ the excess of said sales price above $4.00 per hundred lb.

I have given here as a typical example of a lead schedule of the "unit-and-quotation" type, one taken from the report of the Colorado Commission. For obvious reasons I have omitted the name of the company which issued it, but it was published in 1917, and whether it is in force now or not is immaterial. With it was published a similar schedule for dry and copper ores, and a clause covering concentrates was included.

There is nothing to note about the payment for gold and silver, and the only thing about the penalty for zinc is that 50c. per unit is 2½c. per lb., and the shipper can afford quite a little expense in sorting or other treatment to avoid it.

The payment for copper is low, because, as previously noted, the losses and expenses are high for copper in lead work. The quotation for casting copper is .3 below cathodes, which, in turn, are about .1 below wirebars and ingots, so that the deduction is really 6.4c. per lb. from electrolytic wirebars.

At first sight the lead prices seem to be complicated. Putting them in tabular form has a tendency to confuse, so I have plotted the returns to the shipper by both tables on the basis of 4c. lead, using lead values alone and deducting treatment



charges before plotting. The result is shown by the solid lines in the figure. Where the line passes below the zero line it means, of course, that the indicated quantity must be deducted from the other values in the ore.

Personally, I do not care for schedules in tabular form, because they result in these step curves and there is always considerable jockeying and squabbling around the change points such as occur in this every 5 per cent. At 30 per cent Pb it may be noted that a difference of .1 per cent Pb makes a difference to the shipper of $1.60 per ton although at the price assumed it is only worth 6c.

If any one finds difficulty in using the tables on which to base shipping estimates, a general statement can be calculated without difficulty that will give the same effective result. I have plotted one, and it is shown on the diagram in dotted lines and gives results that vary less from the tabulated values than they differ in themselves. It will cover ores from 5 per cent to 60 per cent Pb, and with prices from 3c. to 9c., a range sufficiently broad. The basis of this curve may be expressed as follows:

Lead: Deduct 1½ units from the wet assay and pay for the remainder at ¾ of the New York price. Treatment charge: $7.00 per ton for neutral ores, 10c. up or down, but the total of such increase for excess silica not to be more than 6c. for each unit paid for less than 45 per cent Pb (dry). No excess silica will be charged on ores with more than 45 per cent Pb (dry). This covers both tables.

When stated in this manner it is to be noted that there is a deduction of 1½ units for losses (Mr. Whitaker's 30-lb.), a deduction from the New York price, which with lead from 3c. to 9c. will vary from ¾c. to 2¼c. per lb., the larger amount in the time of highest price, and presumed to cover refining and delivery. There is also a smelting charge of $7.00 per ton. Somewhere in these amounts is also hidden the profit which the smelting and refining companies expect to make. The expression 10c. up or down is intended to mean that there will be an additional charge of 10c. for each unit (20 lb.), more of silica than iron plus lime per ton of ore, and that if the iron and lime exceed silica there will be a corresponding credit.

Copper

The dry assay of copper is obsolete, though it is sometimes referred to in ore contracts as a kind of explanation for certain deductions; but it really has nothing to do with the case. Of course, the old theory was that the difference between the dry and wet assays represented the smelter losses. It may have, approximately, in the days of Welsh reverberatories, but it does not now and has not since the time water jackets were invented.

Copper is not volatile, and does not appear to any extent in the fume. The only exception is in the case of copper chloride, which it is generally believed is completely volatile. It is rare in North America, and good dust chambers should collect all that escapes from the furnace top.

For many reasons it is usually desirable in custom work to produce about a 35 per cent matte. The result is that in blast-furnace work slags usually contain from .2 to .45 per cent Cu and in reverberatory work from .3 to .5 per cent averaging say .35 per cent. Copper is sometimes used as a collector, and sometimes that property is of secondary consideration. In the first case the amount on the charge will be as low as possible, but in the second case will vary from one extreme to the other. The slag will vary from 60 to 85 per cent of the charge, so that if the average copper in the slag is .35 per cent, the loss may be considered to be .25 per cent or, say, 5 lb. per ton. This will tend to be a constant figure, irrespective of the amount on the charge, and may be considered as a proper deduction. In cases of high iron and low silica slags it will be considerably increased, particularly in reverberatory work. If the copper is being used as a collector, barren ore and fluxes may be added to the slag and will absorb their proportion of copper. Each ore should be charged with the copper necessary to saturate its slag-forming components, as should the fluxes. The total of these

may raise the copper loss from what might have been a reasonable amount to a very large part of the total, both as regards absolute units and as percentage.

From which it follows that the deduction for losses need not be the same on ores containing the same amount of copper. As an example, assume the case of a plant operating with an excess of siliceous ore. One ore is offered that is self-fluxing, that is, it contains the requisite proportion of bases and acids and sulphur to produce the type of slag made at the plant. It will have the average loss at the plant. Another ore is offered consisting, as an extreme case, of copper carbonate and quartz. It will require the addition of lime, iron, and sulphur, and will produce about twice the weight of slag that the former will; therefore the deduction for loss should be double.

Take another case: Assume a plant with ores requiring no flux and producing an ideal slag high in lime and containing little copper. The ore offered in this case, say, is an iron gossan with 5 per cent Cu, no sulphur and 50 per cent Fe. It is true that no additional fluxes would be required, but the effect would be to lower the percentage of silica and increase that of the iron, and thus increase the copper lost in the slag. Roughly, one may say it would have double the normal loss. The same ore delivered to a plant buying barren iron flux would be entitled to credit for the full copper contents, with no deduction for loss at all.

I have before me the open schedule of a Western smelting company, which I recommend for simplicity. After providing for the gold and silver, it specifies that the company will pay for the copper, less a deduction of 1.3 units at the New York price of electrolytic cathodes less 3c. per lb., as quoted by the "E. & M. J." Under present conditions and with present prices the deduction from the New York price is figured about as follows: Selling and delivery commissions are about ⅛c. per lb. each. The last figures that I have seen for refining were 1¼c. per lb. Shipping converter bars from somewhere in the West to Baltimore or New York may be taken at ¾c., converting at from ¼ to ¾c., depending on the condition of the market, as regards ore for the converters, and interest and insurance. Only rough figures can be given, as they are changing rapidly, but it will be seen that 3c. can be accounted for. As regards the 1.3 deduction for losses: The smeltery in question is operating under severe metallurgical conditions and has a much higher loss than most companies are required to meet. It also aims to take some of its profits in a deduction here rather than in the treatment charge.

Some smelters are now making a fixed deduction from the price when copper is low and an additional deduction in the form of a percentage of the increase when the price rises above a certain fixed figure. The idea behind this is supposed to be that when conditions are bad the smelter will make as little profit as possible, thus carrying the miner through the hard times, and when prices rise will recoup himself by correspondingly increased profits. It may be so, but the miner is inclined to regard it as an example of "all the traffic will bear" tariffs. If honestly carried out this arrangement is susceptible of great good to the small companies, but it is also capable of great abuse. Another idea behind it is that the smelter has just as much right to profit by high prices as has the miner. Still another is that the smelting companies are unable to sell their product so as to get the full advantage of the high prices. First, the high prices bring increased production of ore, and it takes from 90 to 120 days to get the product on the market, by which time the peak price has passed. The marketing company could, of course, try to protect itself on the purchase of each lot by selling a corresponding amount for future delivery, but the price for futures at peak times is usually below the peak. A high price is indicative of a sold-out condition of the market and is generally coexistent with a prior selling for future delivery at a price below the peak.

That this is not a fanciful statement may be seen by reference to the table in the Copper Handbook, 1918, page 211, at which the price actually received by many producers is given as 1.5 cents below the average of the quotations for 1916. This year, on account of the large stocks accumulated last winter at the time of low prices, many companies should show large quotational gains. The absolute suspension of quotations for a long time had a demoralizing effect on both shipper and buyer, and the question of what quotation to apply on their resumption was by no means an easy one, and it speaks well for the business as a whole that there was so little friction.

Copper in lead ores is in a better situation than lead in copper ores. It is recovered largely, but the refining and delivery charges are heavy, and so are the losses, as a rule. It is collected as a matte and turned over to a copper smeltery for further treatment, usually with the loss of the accompanying lead.

Silica, Iron, and Lime

These three must be considered together. For many years the payments and deductions for these elements were in most cases based on the theory of type slags, and the development of the industry has consequently been greatly influenced thereby. Just the same, many have been convinced for many years that there "ain't no such animul," and the development of the reverberatory and the production of flotation concentrates are introducing factors that are resulting in an entirely different view of the matter.

The theory of type slags was based on the hypothesis that there are a few limited combinations of silica iron and lime in simple ratios which give much cleaner and more satisfactory slags than any others, even though they may approximate the favored ones closely in composition. It is now known that slags are mutual solutions of various silicates containing dissolved oxides, sulphides, and other materials, all in more or less dissociated state, and that

their properties vary without abrupt changes. According to the original theory, iron and lime had to be provided for the silica in definite proportions, whereas it is now known that these limits are purely economical. Thus it is possible to smelt with a slag containing as much as 60 per cent SiO_2, or as little as 10 per cent, or any point in between, the only limiting factor being the expense bill. A slag may have no lime or it may have 50 per cent and the iron may be from some unknown lower limit to 75 per cent FeO or more, and the correct amount is determined by a balance of the economical forces. Operators do not smelt with a 60 per cent slag—not because it cannot be done, but because it does not pay. The furnace will not run under ordinary conditions of operating, it is true, and the smelter cannot afford to produce the conditions under which it will run.

Now, the bearing of this on the subject under consideration is that the majority of ore schedules are based on the assumption not that is costs $x to smelt a ton of ore, but that it costs $y to smelt a ton of silica, and that iron and lime, being necessary for that purpose, are of value. This is a perfectly legitimate assumption in those cases where barren iron and lime must be added to keep the cost of smelting it at the economical point, but with the coming of flotation concentrates containing iron, and the production of slags containing 36 per cent of silica or less, there may be, and often is, more reason for assuming that it costs $x to smelt a ton of iron and that silica and lime are the fluxes, and it is sometimes assumed that a ton of ore is a ton of ore as far as costs are concerned, irrespective of its contents.

Now it is important to the shipper which one of these views is held by the smelter. From the standpoint of a smelter having all three to draw upon, silica and lime are really of more value than the iron (within limits). In copper smelting for smooth furnace running it is best to have at least 15 per cent FeO in the slag, but from that point up each additional unit has a fouling action on the slag, this being true whether it is substituted for lime or silica, or, what is the same thing in quality if not in amount, added to the other two. Increasing silica or lime decreases the metal loss in the slag. These statements hold true within the present smelting limits, but unfortunately the curves showing the effect of varying amounts of the different substances are not always simple ones. I am, of course, referring to the assay value of the slag and not to the loss in pounds, which is more complicated.

As concerns the schedule, matters of policy may enter largely. A company may be smelting a heavy sulphide ore and obtain sufficient silica at a good treatment charge to produce a 30 per cent silica slag. The addition of more silica would produce a better and cleaner slag, but conditions might easily be such that the offer of a bonus for free silica would produce only a very small additional tonnage and cause the loss of the substantial profit on the original supply.

When a penalty for silica is exacted it is usually based on the insoluble, it being assumed that this will also cover most of the alumina. The silica and alumina determinations are difficult and expensive, and the insoluble is simple and cheap, and therefore will always be used on small lots. The silica and alumina together are generally more than the insoluble, and in such cases the deduction for the insoluble is justifiable, but calcium fluoride, barium sulphate, garnet, and some other minerals are insoluble.

Large amounts of alumina are unquestionably bad and cause all kinds of trouble, but I consider small amounts, say, up to 2 or 2½ per cent, as beneficial rather than otherwise. In fact, I consider small amounts of almost all slag-forming bases as beneficial and attribute the property to the effect of Raoult's Law that the addition of small amounts of dissociated substances in solution lowers the freezing point. This effect is soon overcome by their other properties if increased amounts are added.

Manganese is supposed to act as iron, and is frequently included for payment at the same price. It is said to have a bad effect on silver losses, but I have had no personal experience with large amounts.

Contracts sometimes read that available lime will be paid for. This is intended to exclude calcium fluoride, but the ordinary method of determination will also exclude lime silicates and garnets. The theory is that calcium as fluoride is of no value as a flux. This may be true in lead smelting, but in iron work a good price is paid for it to make a liquid slag. It seems to have this property in copper smelting, and I believe that it has a cleansing action on the slag.

Magnesia is supposed to be a substitute for lime, but it is almost never paid for. I have used it with satisfactory results as a substitute for part of the lime, and one of the fastest running slags that I have ever seen contained more than 10 per cent of this element. It apparently emphasizes the bad properties of zinc when the two occur together, and the fact may be easily explained from a chemical standpoint. The same is said to hold true of barium, but the explanation is not so obvious. In the one case coming under my observation it seemed to be true, but the bad qualities of zinc are so great that it is likely to warp one's judgment as to the effect of small amounts of other elements accompanying it.

Barium occurs as sulphate, and then there is an argument as to whether it is "insoluble" or not, which chemically it is, and penalizable or not, which, in the absence of zinc, I do not think it ought to be. Slags containing large amounts were run in British Columbia several years ago, and from my own limited experience it would seem as though it could be calculated as lime per cent for per cent, but I am not convinced.

Zinc is rightly penalized. There is usually a small amount allowed free. This is also in accordance with conditions. A small amount on the charge does not seem to do any harm; perhaps otherwise. Then its evil effects begin to manifest themselves and become serious when 6 per cent is reached. The free limit is generally higher because some ores carry none and

will help take care of the more zincy ones. It is to be hoped that some method of benefiting by the presence of this element will be discovered, and a means found for avoiding the present enormous waste.

In lead smelting sulphur is a nuisance and requires preliminary treatment of the ore at considerable expense; hence the charge against it. Under the present system of sintering fines a small amount is needed, but there is usually more than required, and a penalty is essential to keep down the supply.

In copper smelting it is absolutely necessary, though in a few contracts I have noticed the rather amusing statement that it will not be charged for. Of course there are some plants which have an excess that must be disposed of, and a penalty is allowable. On the other hand, in a great many camps it should draw a premium. Unfortunately it is extremely difficult to settle upon an equitable basis. The first few units are essential, the next few quite valuable; then they decrease in value until they finally become a source of expense. Furthermore, at the same plant, sulphur in one ore may be more valuable than that in another, depending on the nature of the constituents. The result is that it is usually disregarded in the schedule and provided for by variations in the treatment charge, depending on the probable character of the ore expected under the contract. In many camps such as exist in the Southwest I think that this is a mistake and that some form of payment and penalty depending on the ratio between the sulphur and the copper or some other element, would be desirable. Shippers are prone to look on penalties as an unmixed evil, but there is another side to the shield, even from their point of view. A properly designed penalty will permit of a cheaper total treatment charge and prevent the shipment of material that will be a source of loss to both parties.

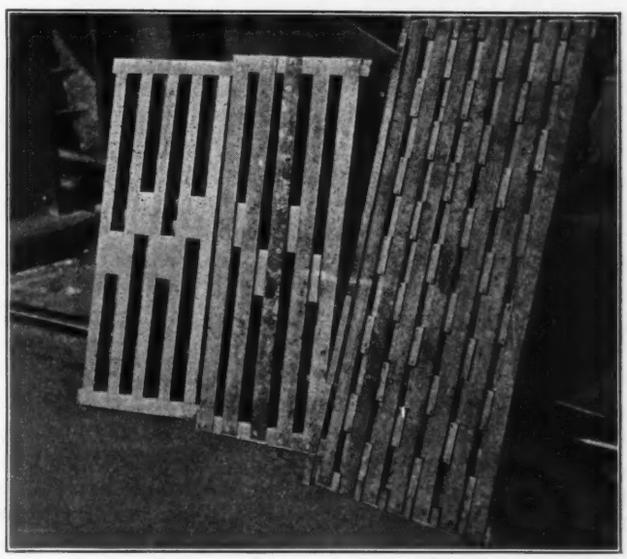
Comes now the shipper and sets forth "Arsenic is selling for 5c. per lb. in New York, and not only am I not being paid for it, but I have to pay a penalty because of its presence in my ore." The amount of arsenic lost in the smelter fume is estimated at four times the total amount consumed in the United States. Who wants to buy it? The present price is due to a combination of the high cost of recovery and a temporary scarcity due to war demands. With the installation of fume-recovery plants, methods of separation for the arsenic, antimony, and bismuth will be developed and ores containing appreciable quantities will profit accordingly, but there will be considerable likelihood of a decreased price due to overproduction.

Treatment charges are of all kinds, flat, sliding scales varying with the value, with the metal contents (lead or copper), with the silica, and many other variations. One of the best, though complicated, was based on the cost of prime materials used in the treatment. This is much what is done in the "Jackson Price" in Chile. There is usually a minimum charge, to be applied on small lots to cover the cost of sampling and assaying. It is not commonly appreciated that the assays made on an ordinary lot at the time of purchase would cost, if made by an umpire according to his regular price, from $20 to $50 per lot. There is usually an additional charge in the case of fines, to cover the cost of briquetting or sintering. It is based on material less than ¼ inch in size.

With the addition of a few special clauses, such as one providing for the transfer of the contract or for reference to arbitrators in case of dispute, this covers the general ore contract. It sounds fearsome, but with a few exceptions is really quite simple, though it will never be like a contract for 1,000 bushels of No. 2 white corn.

Gold-Saving Riffles on a Dredge

The gold-saving riffles used upon the dredges of the Yuba Consolidated Goldfields Co. have been standardized, like most other parts of the dredge. They are made in sections, five riffle bars to a section. The five bars are held by two end pieces and are separated by wooden blocks between each pair, staggered as shown in the photo. The bottom of the section is flush so that it will bear evenly on the sluice.



GOLD-SAVING RIFFLES ON A YUBA DREDGE

The upper face of each riffle is protected by a 1¼-in. iron strap, ⅛-in. thick, held in place by wood screws, the flat heads of which are countersunk. This strap is set at a slight upward angle, the highest edge downstream, the upper surface of the wooden bar being cut at an angle corresponding to the upward tilt of the strap. The side bars have slots cut in them for the reception of the straps.

At intervals in the sluices a mercury, or trap riffle, is placed. In this, the spaces between the riffles are fitted with short wooden bars which do not quite reach the surface of the strap, these wooden pieces dividing each trough into a number of smaller troughs, as shown in the left of the photo. Each pocket is filled with mercury after the section has been placed in the sluice.

The Mackenzie River Basin

Possibilities of the Vast Territory Which Is Being Opened in Northwestern Canada—Geological Features of the Area and Most Favorable Regions in Which to Prospect for Minerals and Oil

BY PHILLIPS THOMPSON

TO THE prospector and the mining man the Mackenzie River basin affords a vast field of unknown but great possibilities. Not only is the greater part of the territory quite unprospected, but more than one-third of it is still unexplored, and even its geographical features are unknown.

With the opening of this region for settlement, increased attention is being given to its economic resources, concerning which the amount of available information is very limited. With the view of presenting, in a concise form, such data regarding the geological features and mineral occurrences of the country as are procurable, the Canadian Geological Survey has issued a volume compiled from numerous sources by Charles Camsell and Wyatt Malcolm, including information acquired by Mr. Camsell in personal exploration.

Vast Unexplored Territory of the Region

The basin of Mackenzie River occupies about 682,000 square miles in the northwestern part of the continent comprising the northern parts of British Columbia, Alberta, and Saskatchewan, the western part of the Northwest territories, and parts of the southeastern and northeastern Yukon. Lakes cover a large part of the area, and though many large bodies of water are still unexplored and unmapped, it is estimated that the water area cannot be less than 40,000 square miles. Its longer axis, about 1,350 miles, conforms in direction to the trend of the main physiographic features, and strikes northwestward. In width, it ranges from 100 miles at the mouth of the river to 900 miles near the center of the basin. It includes within these boundaries three physiographic provinces, each of which runs almost the whole length of the basin and has characteristics which sharply distinguish it from the others.

On the western border, and extending throughout the whole length of the area, is a lofty mountainous district known as the Cordilleran region. It forms a belt varying in width from 20 to 200 miles, extending from the foothills which border the central lowlands to a height of land separating the Mackenzie waters from those which drain westward to the Pacific. The great physiographic province known as the Laurentian plateau, which covers such a great part of northwestern and northern Canada, extends for some distance into the basin of the Mackenzie River, occupying a strip along its eastern edge from 80 to 280 miles wide and stretching over a length of 800 miles from the height of land at the south to the northern shores of Great Bear Lake. The western border of this province is a fairly well-defined line marked by the contact between the Pre-Cambrian crystalline or metamorphic rocks.

The physical features of this province are typical of the whole Laurentian plateau generally. It has, as a rule, little or no soil or loose material covering its bedrock, the region having been subjected to intense glacial erosion. The physiographic province termed the Great Central plain occupies the central portion of the basin, including all the region between the Laurentian plateau on the east and the Cordilleran region on the west. It has a length of about 1,300 miles and its width ranges from a maximum of 420 miles to about 200 miles.

DIAGRAM OF THE MAIN FEATURES OF THE MACKENZIE RIVER BASIN

The distribution of the Pre-Cambrian rocks coincides with the physiographic province known as the Laurentian plateau. On the east these rocks extend over to the Hudson Bay, far beyond the boundaries of the region, but on the west they pass under a cover of later stratified rocks. The contact with these younger rocks runs from Methye portage to the west end of Athabaska Lake, thence down the valley of Slave River to Great Slave Lake, and from the north arm of that lake north-northwesterly to McTavish Bay, on Great Bear Lake. North of Great Bear Lake the contact has not been defined. The Pre-Cambrian rocks of the region have not been subdivided in such great detail as in the Lake Superior region or Northern Ontario, and only three different subdivisions have been recognized and mapped.

The oldest of the three groups consists of highly metamorphosed schists, slates, limestones, quartzites,

and volcanic rocks, occurring in isolated areas as erosion remnants. This group includes formations that have been uncertainly correlated with the Keewatin, Huronian, or Grenville of other regions. These rocks have been intruded by granites or gneisses of probably more than one age. Overlying these two groups is a series of younger rocks, not greatly disturbed, consisting of sandstones, conglomerates, shales, limestones, and some associated volcanic rocks that have been referred to as Keweenawan or Animikie. The rocks which have been more or less doubtfully correlated with the Keewatin or Huronian, consisting mainly of schists, slates, limestones, and quartzites, occur here and there throughout the Pre-Cambrian, in areas usually small but sometimes many square miles in extent. They occur in isolated bands which are merely remnants of formerly more widespread series, and have been so reduced in area by intrusions of granite and by deep erosion that they now form apparently the smallest portion of the Pre-Cambrian.

Though these lands are really not of great extent, they are much the most important economically of all the divisions of the Pre-Cambrian, and although no commercial mineral deposits have been found in this division within the limits of the Mackenzie basin, the rocks of which they consist have been proved in other parts of Canada and the United States to contain valuable deposits of gold, silver, and iron ores. The rocks are frequently traversed by quartz veins, which, in a band on Yellowknife River, are known to carry free gold. It is advisable, therefore, for the prospector working in the Pre-Cambrian of this region to pay particular attention to these rocks, as they are more likely than any other formation to contain ore deposits.

Gold Placers Not Likely to Be Found

Gold has not been discovered in any important quantity in the Mackenzie basin east of the Rocky Mountains, and the extent of country known to be favorable for prospecting for it limited. Gold has been found in small quantities on Peace River above the mouth of Battle River, on the Loon and the McLeod rivers, and in some other localities, but the glaciation to which the Pre-Cambrian area was subjected renders the occurrence of important placers highly improbable.

Coal is one of the most important resources of the Mackenzie basin, and occurs in the Cretaceous formations of the southern part of the basin and in the Tertiary formations of the northern parts. Mining operations are being conducted on important seams in the Cretaceous rocks along the Grand Trunk Pacific Ry. The report contains descriptions of the principal less-known deposits found in the north, including those on Smoky River, and in the Peace River district.

An immense body of bituminous sands, so-called tar sands, is exposed on Athabaska River, extending from Boiler rapid, about 200 miles below Athabaska, to a point many miles below McMurray. Outcrops occur, also, in the banks of the rivers and many small streams tributary to the Athabaska between these points. Although the area represented by actual outcrops has not been determined, it is probably not less than 750 square miles. The estimated thickness of the bituminous beds and the overburden, and the conclusions to be drawn are based wholly on surface indications. In 1915, experiments were conducted on the commercial utilization of the bituminous sands in street construction in the city of Edmonton, the result indicating that they could be successfully used for this purpose. The conclusion reached from a comparative study of cost data, as compared with imported asphalts, was that the application of the bituminous sands in a crude state to pavement purposes will be restricted within comparatively narrow limits in western Canada, and that extensive development of the McMurray deposits will probably depend on the evolution of a commercial extraction process, whereby the bitumen can be marketed in a fairly pure form.

Attention has for some time been directed to the possibilities of discovering petroleum and natural gas in localities where numerous striking indications of their occurrence have long been known. Boring operations have been conducted along Athabaska and Peace rivers, where strong flows of gas were struck in two or three wells, and petroleum-bearing strata on Peace River have been penetrated. Oil and gas indications are found in the sediments of Cretaceous and Devonian age, both of which are of wide distribution. From the point of view of the prospector for oil or gas, the McMurray sandstone is, so far as present knowledge goes, the most important formation of Cretaceous age in the Mackenzie basin. It comprises the great body of bituminous sands exposed on the Athabaska River, and is the formation from which issue the strong flows of natural gas struck in the wells sunk by the Dominion government and by the Pelican Oil and Gas Co. in the vicinity of Pelican River.

No important deposits of copper, silver, or iron are known to exist, though argentiferous galena containing 38.86 oz. of silver to the ton of pure galena is stated to have been found at a point in the vicinity of Great Slave Lake east of Resolution. No nickel deposits of economic value have been discovered, but nickeliferous sulphides occur at the east end of Lake Athabaska, where a number of claims have been staked. Gypsum is exposed at many points, the deposits most likely to prove commercially valuable occurring on Peace River and in the escarpment to the west of Slave River. Considerable interest has been manifested in the possible occurrence of potash in commercial quantities, but analyses of samples taken from brine springs and waters from strata pierced in boring operations have proved disappointing. There are numerous brine springs, from some of which salt is obtained for local consumption.

Considerable Water Power Available

Water power will be an important factor in the development of the region, because of the scarcity of coal. As in the Laurentian plateau regions elsewhere, the rivers of the eastern part of the basin

contain a number of falls at which power could be developed, including Black River, at the east end of Athabaska Lake, and Taltson, Lockhart, and Yellowknife rivers, flowing into Great Slave Lake. Water power could also be developed on Peace River at the chutes, on Slave River near Fort Smith, and on a number of rivers which fall over the face of the Devonian escarpment south of Great Slave Lake.

Sorting Ore in Raises

BY A. C. BIGLEY

At one of the important mines in Butte, Mont., ore sorting chutes are used in all raises. As a rule the sorting is done on the fourth or fifth floor above the sill. Fig. 1 shows a raise having two chutes and a manway in between. If chute A is drawn first, the chute directly below it is used for ore and the one alongside it below, B, receives the waste. Under the lips of chutes A and B grizzlies with bars 4 or 5 in. apart are used. Some of the bars of the waste grizzly must be removed to admit the large pieces of waste.

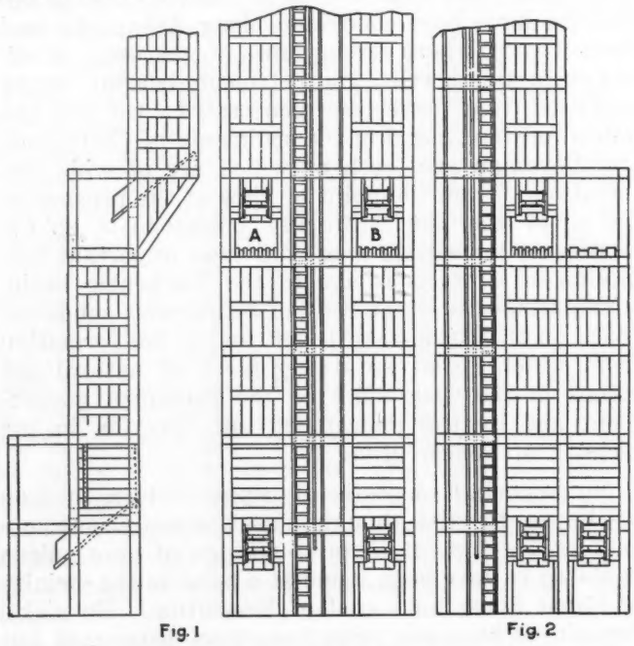


Fig. 1 Fig. 2

ORE SORTING CHUTES FOR RAISES

In drawing chute A the broken ore and waste from the blast is allowed to run on to the grizzly beneath the lip until it begins to heap up. Most of it, having been broken fine, passes readily between the bars. The larger pieces of ore must be broken with a sledge so that they will pass through. Such waste as will not pass is picked out and thrown down the waste chute under B. After chute A is empty, or enough ore has been drawn, chute B is drawn in similar fashion, the chute under the lip of A now becoming the waste chute.

Fig. 2 shows a raise having one chute and a manway, with an extra chute for waste carried up as far as the sorting floor. This extra chute is directly alongside the main chute, to facilitate handling the large pieces of waste.

Foreign Trade in Metals and Ores

Imports and exports of the more important metals and ores, as reported by the Department of Commerce for October, 1919, and the figures for October, 1918, as finally revised, are as follows:

IMPORTS, OCTOBER, 1918, AND 1919
(In pounds unless otherwise stated)

Metals and ores:	Oct. 1918	Oct. 1919
Antimony ore, contents	36,271	14,054
Antimony matte, regulus or metal	3,025,609	2,420,025
Copper:		
Ore, contents	2,908,758	4,004,003
Matte and regulus	3,156,878	3,256,640
Concentrates, contents	4,046,730	3,208,468
Imported from (in part):		
Canada	917,162	3,051,262
Mexico	5,742,618	6,493,722
Cuba	1,959,063	221,760
Chile	713,349	30,223
Peru	1,655	166,865
Venezuela	352,736	Nil
Unrefined, black, blister, etc	33,884,114	17,392,398
Refined, in bars, plates, etc	2,080,763	Nil
Old, etc., for manufacture	43,863	182,001
Composition metal, copper chief value	Nil	224,109
Lead:		
Ore, contents	2,247,673	3,036,568
Bullion, contents	11,252,412	8,285,550
Imported from (in part):		
Canada	1,654,000	885,614
Mexico	11,846,085	8,706,834
Pigs, bars and old	9,812	1,721,764
Pyrites, long tons	35,051	67,155
Imported from (in part):		
Spain, long tons	Nil	42,707
Canada, long tons	35,051	19,548
Tin ore, long tons	50	2,366
Tin bars, blocks, pigs, etc	9,885,984	16,210,512
Imported from (in part):		
Straits Settlements	6,448,003	11,611,756
Dutch East Indies	792,041	742,104
United Kingdom	1,355,405	3,226,310
Australia	592,055	510,760
Hongkong	544,330	Nil
Zinc:		
Ore, contents	4,104,712	2,998,115
Imported from:		
Canada	190,000	220,993
Mexico	3,914,712	2,777,122
Blocks or pigs, and old	Nil	469
Manganese ore, long tons	48,917	15,863
Imported from (in part):		
Cuba, long tons	6,176,171	32
Brazil, long tons	37,885	8,620
British India, long tons	Nil	2,300
Tungsten ore, long tons	959	592

EXPORTS OF COPPER, LEAD AND ZINC
(In pounds)

Aluminum:	Oct. 1918	Oct. 1919
Ingots, metals and alloys	1,258,090	389,009
Plates and sheets	133,254	47,099
Copper:		
Ore, contents	364,000	3,000
Concentrates, contents	15,400	46,457
Unrefined, black, blister	110,066	Nil
Refined, in ingots, bars	31,088,599	44,001,239
Exported to (in part):		
France	7,906,150	18,637,926
Italy	7,404,974	Nil
United Kingdom	7,579,083	11,233,988
Canada	5,561,528	2,689,079
Sweden	Nil	246,400
Composition metal, copper chief value	5,447	5,297
Old and scrap	332	2,355
Pipes and tubes	257,291	785,585
Plates and sheets	301,029	698,132
Wire, except insulated	2,439,991	4,112,327
Lead:		
Pigs, bars, etc., produced from domestic ore	3,686,207	4,593,603
Pigs, bars, etc., produced from foreign ore	3,551,419	3,742,333
Exported to (in part):		
Canada	198,124	158,530
United Kingdom	4,182,248	448,000
Argentina	Nil	1,120,000
Japan	2,464,000	4,109,929
France	Nil	1,120,000
Brazil	336,103	604,075
Zinc:		
Dross	2,373,237	42,100
Spelter:		
Produced from domestic ore	12,948,271	21,426,860
Produced from foreign ore	2,927,366	190,950
Exported to (in part):		
France	672,000	2,364,510
Italy	158,053	236,904
United Kingdom	13,069,286	10,615,759
Canada	1,068,411	605,534
Mexico	2,173	Nil
Japan	628,098	5,934,472
In sheets, strips, etc	4,208,002	2,756,837

A hearing in the matter of the steel-price basing point was held before the Federal Trade Commission on December 2. The commission received a large number of statements from important interests on each side of the question.

Exploration in Southeastern Asia

Prospecting of Virgin Territory Difficult Owing to Jungle and Infrequent Outcrops—Natives a Source of Information, but Many Dialects Make Interpreters Necessary—Government Co-Operation Must First Be Secured

BY MICHAEL H. LOVEMAN
Mining Geologist, 32 Broadway, New York

THE facts to which attention is directed in the paper here presented should be of interest at the present time, when renewed activity is being manifested in the mineral exploration of little-known regions. They are based on experience gained in Burma, but are in a general way applicable to the greater part of southeastern Asia.

An absolute essential to exploration work of any magnitude in the Far East is the assent and, in fact, co-operation of the government of the country in which it is carried out. An attempt to search for mineral deposits without the previous consent of the government would involve certain failure of the expedition.

Exploration work in an unexplored country is of two types: (1) Virgin prospecting, by which is meant the examination of a section of country concerning which nothing regarding definite occurrences is known. This type of work implies the examining of outcrops and of stream float and thorough cross-examining of the natives of the country. (2) The investigation of reported occurrences where the approximate situation and kind of ore are already known and the presumed existence of which is the reason for the expedition. This second type is not discussed in this article, as it is analogous to examinations of prospects anywhere, and differs only in the fact that the information is generally vague and may eventually prove to have no basis in fact.

The physical difficulties met in the tropics, such as transportation, distance from supplies, and rainy seasons, merely call for a general knowledge of the country, and a sensibly equipped expedition will have no troubles of any magnitude.

Few Outcrops Make Prospecting Difficult

Virgin prospecting through practically all the region under discussion has to combat the serious obstacle of heavy jungle and a thick covering of soil, with a consequent great paucity of outcrops. The trails in all countries of heavy rainfall such as southeastern Asia follow the ridges wherever possible, and descend into the valleys only for short stretches. Contradictions to this occur only when the valley bottoms are fairly wide and flat, in which cases the valley floors are covered with fluviatile deposits and are generally cultivated. The search for outcrops would thus entail the cutting of paths through the jungle and would take a prohibitive amount of time in relation to any possible results.

It is obvious that, even with any help derived from technical knowledge, it is impossible to go over any definite section of ground in a few days as thoroughly as has been done by the inhabitants of the district in the course of their daily work over a prolonged stretch of years. The hill tribes of southeastern Asia are all hunters and fishermen, and during the course of their daily wanderings have explored practically all accessible points in the neighborhood of their homes. The constant moving of the settlements themselves implies the acquisition of knowledge concerning a wide range of territory.

It is, of course, true that the almost absolute ignorance of the natives concerning the various ores, combined with their lack of interest, may be the cause of their overlooking mineral deposits. However, the appearance and weight of the commoner metallic minerals, such as pyrite, chalcopyrite, hematite, sphalerite, and cassiterite, unusually attract the attention of anyone, even if he is not looking for them. That their presence has been noted by the natives is evidenced by the fact that mineral specimens have been observed in the houses of villages near deposits. The rapidity of erosion of exposed outcrops is so great that the sulphides almost invariably outcrop on the surface, thus doing away with the oxidized ores which are recognized with greater difficulty. This is not always true of the copper minerals, but among these the appearance of the oxidized ores is more striking than that of the sulphides.

An examination of an area by means of working along its lines of drainage is extremely unsatisfactory, as the distance that sulphide float of any appreciable size is carried from its source is generally measured by yards rather than by miles, and this implies the working of streams practically up to their sources. To do this carefully entails a prohibitive amount of time, two miles of stream bed having been found to take a full day's work. The question of float in streams really falls into the category of things as to which better results can be obtained by questioning the natives rather than by actual search. Float other than in stream beds is practically non-existent.

Questioning Natives Produces Best Results

It follows naturally from the above that the most productive method of prospecting is by means of inquiries among the natives. This method is of necessity a leisurely one, as information must generally be secured by indirect methods, entailing time and patience. The payment of small sums of money for information is, of course, necessary. The amount asked depends largely on the eagerness shown by the questioner, but it is, even in the cases of the larger demands, a small sum, and can generally be made partly dependent on whether the information turns out to be of any value.

The ignorance of the natives about the various minerals entails a great amount of useless work in reported occurrences. Reported gold or copper is

generally found to be pyrite; silver, muscovite; coal, a dark carbonaceous band; iron, any red-colored rock. The obvious remedy for this is to insist on seeing actual specimens from the reported localities before visiting them. This is generally satisfactory as far as determining the kind of ore is concerned, but is useless as to grade. The invariable careful selection of specimens is carried to such an exteme that the least mineralization is made to produce high-grade samples. It is sometimes possible by carefully interviewing the bringer of specimens to ascertain in a way the nature of the deposit, but the information derived in this manner is always so vague and unsatisfactory that it is of no help in coming to a decision as to whether to visit the spot or not.

Ancient Workings Help, but Are Hard to Find

In all the sections contiguous to the southern border of China, and, to a lesser degree, in those more distant, the presence of ancient workings is a prominent aid to prospecting. This is not so much owing to the help which they afford in actual examination of the deposits, as because of the fact that their existence is generally known over a wide stretch of country. Information as to the existence of such workings has been secured from points forty to fifty miles distant. In fact, villagers at a distance from a deposit are generally more free with their information than those close to it; the latter often being afraid of interference with their normal life.

Ancient workings are generally hidden in dense jungle, the old dumps apparently favoring the growth of heavy vegetation, especially of undergrowth. In one case, at least, an hour or more had been spent by three or four men in finding a single tunnel, when the final result revealed six old workings within a radius of a hundred yards.

As far as their being an aid to examination is concerned, the ancient workings generally prove disappointing. The majority are either caved, generally at the mouth of the tunnel, or filled with water. Most of them are inclines sloping at 20 to 45 degrees. A moderate amount of work will often make them accessible, but it is generally necessary to do fresh underground work to secure reliable information.

Inability to speak the language of the natives is naturally a drawback, but practically an unavoidable one. The mountainous regions of southeastern Asia, especially the areas bordering on China, are not inhabited by a single homogenous race of people, but by a large number of races; each speaking a distinct dialect. If the territory covered by an exploring party be large, it is inevitable that the members of the party will have dealings with numerous races, thus making necessary the use of a number of little-known languages. It is practically impossible for the members of a temporary expedition to acquire a knowledge of these tongues. Recourse must, of necessity, be had to native interpreters. In many instances it will be necessary to translate the conversation through two stages, namely, from the language of the hill tribe to the general language of the country, and then into English. Naturally such a process is unsatisfactory, but is less of a drawback than would appear at first glance. As mentioned previously, the knowledge secured by questioning natives is vague and unsatisfactory. The main object of the questioning is therefore simply to secure two items of information: (1) Whether any valuable minerals have been observed in the neighborhood; (2) how to get to them, the latter meaning simply the securing of a guide. This limited amount of information can generally be satisfactorily secured through interpreters. As an aid to obtaining an answer to the first question, exhibiting of type specimens of the different minerals has proved of help. Owing to a human trait, a native is more apt to impart information to one of his own kind than to one of an entirely different race, even if the latter has a knowledge of the local tongue. This fact is an argument in favor of using an interpreter, even if he is not actually necessary.

It will be understood from the observations set down that virgin prospecting by itself in the section discussed involves a rather slow trip through the country, and that the main chance of finding mineral deposits is through information secured from the inhabitants. The possibility of finding valuable mineral deposits in this fashion is so uncertain that it rarely attracts capital.

Geologists Leaving Government Employ

Seventeen per cent of the scientific force of the U. S. Geological Survey resigned during the last fiscal year, it is shown by the annual report of its director, Dr. George Otis Smith. The cause, Dr. Smith points out, is inadequacy of compensation. Separations in the clerical force were much larger than in the scientific force, for the same reason.

"The relation between Government salaries and outside salaries of geologists," says Dr. Smith, "has been determined definitely in a compilation of the records of twenty-nine geologists who left Government service after receiving an average salary of $2,271. The average initial salary of these men in private employ was $5,121, and after two years of service this compensation averaged $7,804. Eight of these geologists received $10,000 or more. The disparity is even greater if consideration is given to the large financial returns from investments made by the private geologists in connection with their professional work, a privilege properly denied by statute to the official geologist.

"That the value of these men as specialists and consulting geologists is far greater to the country at large than to private corporations is undeniable. Furthermore, it is important to note that most of these geologists had resisted to the limit of endurance, with a magnificent spirit based on their love of scientific research, and their desire to contribute to the sum of geologic knowledge. Unless adequate measures are taken to ameliorate the situation, the geologic staff is destined to suffer far greater deterioration of morale and depletion in its ablest, most responsible, most experienced, and most valuable members."

PETROLEUM SECTION

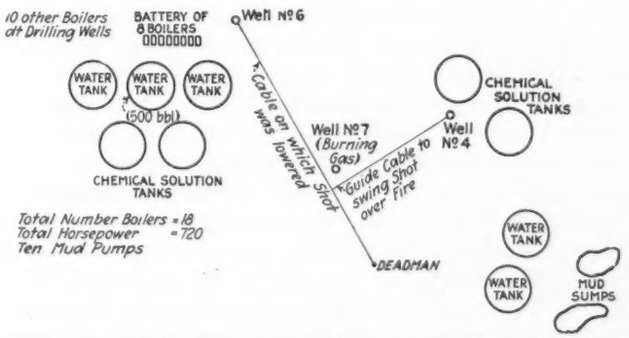
Engineering Notes and Equipment Details
Production Statistics — Progress
in Important Fields

Extinguishing a Burning Gas Well

Exploding of Nitroglycerine, in Conjunction With the Use of Steam, Water and Slime, Proved Successful—Details of the Process

BY SETH S. LANGLEY
Mining Engineer, Taft, Cal.

ON JUNE 6, well No. 7, of the Standard Oil Co., California, on Sec. 36, Township 30 N., R. 23 E., M. D. B. & M., was being bailed to bring it in as an oil well, when gas broke in and caught fire. The 6-in. casing had been cemented at 1,800 ft., and the total depth of the well was 2,141 ft. This cement job must have failed, as the gas sands in the other wells are at a correlative depth above 1,800 ft. As well No. 4 had broken in as a gas well, the casing on No. 7



GENERAL ARRANGEMENT OF TANKS, BOILERS AND WELLS

was provided with a gate and relief valve to meet such a contingency. When the drillers heard the gas coming they were able to close the gate and open the relief valve, but the pressure was too great and tore off the fittings. The fire did not start at once, but broke out about an hour later. It was apparent that this was a much bigger gasser than No. 4, but the steam from sixteen boilers had been all that was necessary in that case, and eighteen were at once made ready.

After clearing away the remains of the drilling equipment, an attempt was made to smother the fire with steam. Several attempts resulted in failure. The gas had been bringing sand and shale with it to such an extent that the two upper joints of the casing were worn away and the hole enlarged around the collar of the well. This allowed the flame to reach down below the surface and increased the difficulty of smothering. After the steam had proved of no avail, water and slime were added with no better success. The next attempt included all of these with fifteen tons of a solution of carbon tetrachloride and as much sulphuric acid and bicarbonate of soda. The fire refused to smother. The best that had been accomplished was to lower the flame to a point about 40 ft. above the collar of the well.

The last and successful attempt was most ingenious. A cable was strung from a nearby rig to a deadman beyond and in line with the fire. To this a second cable was attached from another rig, the two cables forming a right-angle at the fire. The second cable was to serve as a guide to swing the first directly over the well. With the steam, water, mud, and chemicals turned on, and the fire lowered to about 40 ft., a charge of 150 lb. of nitroglycerine was guided down the first cable directly above the flame. The shot was detonated by a battery and the fire was out on Aug. 5, 1919. The figure is a general sketch of the arrangement finally used.

[The means employed to extinguish the fire at well No. 4 were described in the Journal of July 12, 1919, on page 73.—Editor.]

Status of English Oil Development

According to the American Chamber of Commerce in London, the oil discovery at Derbyshire, England, which caused so much excitement some few months ago, has amounted to practically nothing. The Hardstoft boring, at which the strike was made, is still the only one to have come in, and even there the flow is small. The bore hole is now down 2,800 ft. and has passed through two colliery workings, but the yield of oil was only about 2,000 gal. per day. A powerful pump, introduced in the hope of increasing the flow, has now broken down, and the oil is penned up in the bore hole, escape having been cut off by means of a safety valve. It is hoped, however, that the subterranean supply is good, because the flow up to the present has been continuous.

The other borings, at Ironfield, Reinshaw, Ridgeway, Brimington Common, and Heath, have not struck oil at all. It is reported that drilling on these sites has been suspended, owing to the non-arrival of the steel tubes necessary to keep out the water and to prevent oil from escaping in any subterranean crevice which the drill may have passed through.

No Japanese Oil Concessions in Mexico

Persistent rumors that Japanese are acquiring petroleum lands along the Gulf Coast of Mexico were denied emphatically by the Secretary of Industry and Commerce of Mexico, according to official information reaching Washington. Not a single concession of such a nature, up to the present time, has been granted to Japanese subjects, it is stated.

Irish and Scottish Oil Shale*

Geological and Mineralogical Character of Deposits, and Estimation of Reserves—Yields of Oil and Sulphate of Ammonia

THE earliest recorded production of oil shales was in 1873, when the output amounted to 542,643 tons, and there was a steady increase until the year 1913, when the highest production, amounting to 3,280,143 tons, with a value of £822,394, was reached, all of which, with the exception of 240 tons from Flintshire, came from Scotland.

Oil shale has been obtained during varying periods from many English counties, but the Scotch deposits in the counties of Edinburgh and Linlithgow have at all times been the most important.

Some clay rocks split readily into fine leaflets or laminæ parallel to their bedding, and this structure is accentuated by films of other materials, such as sand or vegetable debris. Laminated clays of this nature are generally known as shales. They are found in many formations, but are most common in the carboniferous. Some of them contain much organic debris, and when distilled yield paraffin oil, wax compounds of ammonia, and other products. In these oil shales are clear, globular, yellow bodies which seem to be resinous, and a suggestion has been made that the admixture of large quantities of decomposed fresh-water algæ among the original mud explains the origin of paraffin. Many shales contain great numbers of nodules of clay and ironstones, and others are rich in pyrites which on oxidation produce sulphuric acid; this attacks the aluminous silicate of the clay and forms alum shales. The lias shales of Whitby contain blocks of semi-mineralized wood or jet.

Geological Character of Deposits

The oil-shale measures of Scotland form part of the calciferous sandstone series which embrace two subdivisions. The upper, known as the shale group, is over 3,000 ft. in thickness and contains in its higher parts, beds of coal usually of inferior quality and further down about six main seams of oil shale interstratified with beds of sandstone, shale, fireclay, marl, and estuarine limestones. Oil shale is found both in the coal measures and in the carboniferous limestone series of Scotland, and has been wrought in various localities together with seams of coal and ironstone. At present practically none of these shales is considered workable, exclusive attention being paid to the valuable seams occurring in the calciferous sandstone series. In thickness these seams vary greatly. At certain localities they disappear, passing into ordinary carbonaceous blaes, and at others swell to 6 or perhaps 15 ft. in thickness.

There is undoubtedly a considerable resemblance between the Scottish shale measures and those found in the Ballycastle mineral field in the North of Ireland. The field is in the lower carboniferous series, and the calciferous sandstone series being composed of massive sandstones, shales, thin beds of limestone, ironstones, and coal seams. A good section of the lower carboniferous series can be found on the cliffs forming the coastline between Ballycastle and Fair Head, showing the outcrop of the different seams.

Possibility of Future Developments

As pointed out, the shale seams in the Scotch carboniferous series have hitherto been but little availed of for exploitation, but it would be premature to depreciate the value of Irish measures on that account. It is stated on good authority that the 8-ft. seam of limestone which outcrops in part of the Irish field at Colliery Bay is recognizable as the Burdiestone limestone, a well-known horizon on the Scottish field. As the outcrop of this 8-ft. bed is at sea level, it is anticipated that there should be a considerable thickness of productive strata below this horizon. At Pumpherston in Scotland there is up to 1,000 ft. of productive strata below the Burdiestone limestone. At Colliery Bay the outcrops are first met about half a mile to the east of the town of Ballycastle, continuing for a distance of four miles to Fair Head. The cliffs gradually rise in height from 159 ft. near Ballycastle to 636 ft. at Fair Head. The seams of shale outcropping on the cliffs are eight in number, varying in thickness from 3 to 17 ft., making a total thickness of 90 ft. of shale, of which about 25 ft. is true oil shale.

As numerous mines have already been driven into the face of the cliffs to work the coal and ironstone, it might be possible to restore them with but little expense to work the seams. The total area of this district is 9,230 acres, and the shale reserves have been estimated at 189,000,000 tons. This computation allows for 25 per cent for losses incurred in connection with faults, intrusions, and loss in working, and takes into account only 5,600 acres, as the remainder would be required to be proved by boreholes. A drawback in connection with the Ballycastle field is the presence of many faults and disturbances which follow a more or less north-and-south course, splitting up the field into numerous divisions. Practically the whole of the region is capped with sheet basalt and, unfortunately, in one section zones of this material are noted through the stratified rocks.

The Irish field is not, however, peculiar in the possession of these disadvantages. Broadly speaking, the effect produced on oil shales by the intrusion of igneous rocks depends on the proximity, the temperature, and mass of the intruded matter, and the amount of water with its cooling power in the sediments which are invaded. Specimens of Broxburn shale taken some distance apart from localities beneath the dolorite sill—a coarse variety of basalt—near Newbygen gave some interesting results. Two samples yielded 23 gal. each, which was comparatively low, but the other two gave 31 gal. each, the explanation probably being that the igneous rocks were further off.

Again, in another part of the Scotch field, near Drumshoreland, the existence of a basalt dike about a mile or two long has had the effect of rendering useless the shales for about a distance of 70 ft. on either side. A process of distillation of the shales has been evidently carried on here by the molten

*From "The Statist," London, Oct. 11, 1919.

material. The basaltic cap is not of general occurrence in the Irish field. Around Ballyvoy it is absent, the strata are covered with a considerable thickness of drift, and consequently better inducements for working might be afforded here. It is stated that shafts sunk in the locality have cut through at 120 ft. a seam of shale 15 ft. in thickness; and, directly over the coal seam, a seam of shale 60 ft. in thickness was encountered.

A distinct similarity has been traced between the cannel coal once mined in Ballyvoy and the highly-bituminous Boghead coal or Torbanehill mineral, returning 120 to 130 gal. of crude oil per ton, and worked out in Scotland in 1862. The main difference between shale and cannel coal consists in the percentage of ash, rich shales approximating to the coal in their composition. This is well illustrated by the New South Wales kerosene shale, which contains only 8 per cent of ash, and a splinter of which will burn like cannel coal.

As regards the oil yields from Scottish shale, the figures vary for the richer kinds from between 30 and 40 gal. per ton, but the higher yield is usually obtained at the expense of the solid paraffin and of the quantity of heavy oils. Contrasted with this the Irish yield is comparatively low, but in this connection much would depend on the extent to which investigation was restricted to outcrops. It is also worthy of notice that the inferior shales in Scotland, producing about 18 gal. of oil per ton, give a proportionately larger amount of sulphate of ammonia.

The Ballycastle field is not unfavorably circumstanced for development. The town of that name is connected with the standard Irish gage railway by a narrow gage line seventeen miles long, the latter, however, being capable of considerable improvement. As the area is situated on the coastline, the sea would provide an alternative method for disposing of mineral products were harbor accommodation sufficient. The coal reserves are estimated at 83,000,000 tons, and it is unnecessary to emphasize the advantages of the centre as a coaling station and its favorable position for business connections with the industrial area in Ireland, the South of Scotland, and the North of England.

The oil shales of Scotland yield by destructive distillation at a bright-red heat, crude oil and ammonia, and this oil furnishes on fractional distillation a series of products resembling those obtained from its rival, petroleum. It yields from 3 to 6 per cent of gasoline and naphtha, about 30 per cent of burning oils (for use in lamps), about 9 per cent of gas oil, 20 per cent of various lubricating oils, and about 10 per cent of paraffin.

Of course petroleum products are more easily and cheaply won than those from shale. The crude oil of the former is obtained without the expense of mining and retorting. A bore is simply put down and tubed and the oil flows like a fountain or is brought to the surface by a pump. In this state it is much easier to refine than that produced by the violent method of the shale retort which yields unsaturated hydrocarbons and a little sulphur.

Crude petroleum in its first distillation separates a considerable proportion of burning oils which require only one treatment each with oil of vitriol and soda to render them fit for the market. Scottish burning oil, on the other hand, demands three or four distillations. A gigantic bench of 60 retorts with 250 tons of shale put through every day gives a very thin stream of crude oil and ammonia water. Nevertheless, there are consolations in the presence of ammonia and in the issue of more homogeneous products as a result of repeated distillation.

California Oil Production and Developments for October

The production of oil in California fields during October, according to information given out by the Standard Oil Co. of California, amounted to 277,589 bbl. per day, a decrease of 3,205 bbl. daily as compared with September. October shipments were 306,060 bbl. per day; a decrease of 1,592 bbl. per day as compared with September. Stocks were decreased 882,601 bbl. during the month. Forty-nine new wells were completed during the month, with initial daily production of 5,960 bbl.

SUMMARY OF DEVELOPMENTS AND PRODUCTION FOR ALL CALIFORNIA OIL FIELDS FOR OCTOBER

FIELD	New Rigs	WELLS				Production Per Day
		Drilling	Completed During Month	Abandoned During Month	Producing	
Kern River	5	22	16	....	2,035	20,040
McKittrick	....	9	....	1	347	7,317
Midway-Sunset	10	74	6	....	2,339	87,800
Lost Hills-Belridge	2	19	3	....	558	11,740
Coalinga	5	35	8	2	1,223	44,608
Lompoc and Santa Maria	3	24	4	....	377	16,980
Ventura County and Newhall	2	34	4	2	496	4,930
Los Angeles and Salt Lake	....	2	....	....	666	3,762
Whittier-Fullerton	19	126	8	....	876	80,190
Summerland	....	.....	....	....	142	147
Watsonville	....	.....	....	....	5	75
Totals	46	345	49	5	9,064	277,589

Total crude oil stocks, October 31, 1919.....32,017,037 bbl.
Total shipments from fields, October, 1919..... 9,487,858 " "

CRUDE OIL PRICES AT THE WELL

San Francisco, Nov. 14, 1919

Effective June 10, 1919, Standard Oil Co. offers the following prices for crude oil at the well.

San Joaquin Valley Fields

Kern River, Midway-Sunset, McKittrick, Lost Hills-Belridge, Coalinga.

	Per Bbl.
14° to and including 17.9° gravity	$1.23
18° to and including 18.9° gravity	1.24
19° to and including 19.9° gravity	1.25
and for each increase in gravity of one (1) full degree above 19.0° gravity, up to and inclusive of 36.9° gravity, two (2) cents per bbl. additional.	
37° to and including 37.9° gravity	1.62
and for each increase in gravity of one (1) full degree above 37.0° gravity, three (3) cents per bbl. additional.	

Whittier-Fullerton and Santa Maria Fields

	Per Bbl.
16° to and including 17.9° gravity	$1.23
18° to and including 18.9° gravity	1.24
19° to and including 19.9° gravity	1.25
and for each increase in gravity of one (1) full degree above 19.0° gravity, up to and inclusive of 36.9° gravity, two (2) cents per bbl. additional.	
37° to and including 37.9° gravity	1.62
and for each increase in gravity of one (1) full degree above 37.0° gravity, three (3) cents per bbl. additional.	

California Petroleum Development Activity is indicated by reports filed with the California State Mining Bureau, Department of Petroleum and Gas, during the week ended Oct. 4, 1919, which show sixteen new wells ready to drill, making a total of 501 since the first of the year. Other operations reported are 26 tests of water shut-off; 14 deepening or redrilling jobs; and 6 abandonments.

Natural Gas and Natural Gas Gasoline in the United States

Great Increase in Value of Natural Gas Used—The Recovery of Gasoline From Natural Gas Has Become a Large Industry

MORE than 2,100 cities and towns in the United States are supplied with natural gas, which is furnished to domestic consumers at rates that should arouse the envy of those consumers of artificial gas who have to pay about a dollar a thousand cubic feet. The average price per thousand cubic feet charged to domestic consumers of natural gas in the United States in 1917 was about 30c. The average price charged to manufacturers was less than 12c.

Most of the towns and cities supplied with natural gas are in New York, Pennsylvania, Ohio, West Virginia, Kansas, Oklahoma, and California. In Ohio, 872,000 domestic consumers were supplied in 1917, in Pennsylvania 480,000, in California 239,000, in Kansas 188,000, in New York 164,000, in West Virginia 129,000, and in Oklahoma 95,000. The industrial consumers, by whom the gas is used for manufactures or for generating power, use twice as much gas as the domestic consumers.

During the present century the value of the natural gas used in the United States has risen annually without break from $27,000,000 to $142,000,000 and is still rising.

A report on "Natural Gas and Natural Gas Gasoline in 1917" by John D. Northrop, just published by the U. S. Geological Survey, gives statistics of the production and consumption of natural gas and sketches the condition of the industry in twenty-five states. It gives also statistics concerning gasoline made from natural gas in that year.

Gasoline From Natural Gas

The recovery of gasoline from natural gas has now become a large industry, which contributes materially to the supply of motor fuels. Experiments in the conversion of natural gas to gasoline were made as early as 1903, but experiment did not give way to commercial production until about 1910. The growth of the industry since that year has been remarkable. In 1911 there were in operation 176 plants, which produced about 7,400,000 gal. of raw gasoline from natural gas. In 1917, only six years later, there were 886 plants, which produced nearly 218,000,000 gal.

Prior to 1916 most of the gasoline recovered from natural gas was derived from casing-head gas obtained from oil wells, by methods involving compression and condensation, but from year to year an increasingly large proportion of the annual output of natural gas gasoline has been recovered by the absorption process, which has now been applied not only to "wet" gas from oil wells but also to so-called "dry" gas, which occurs independent of oil and constitutes the main supply of natural gas. Dry gas cannot be profitably converted into gasoline by compression.

New Petroleum Legislation in Rumania

A communication from the British commercial secretary at Bucharest printed in the "Board of Trade Journal," London, Oct. 16, 1919, reports that a new law of Sept. 12 provides that all those properties in Rumania upon which no work has as yet been done shall be subjected in their future working to laws which are to be passed later. This is considered in many quarters as a preparatory measure to enable the Rumanian government to become an interested party in their exploitation. This point, however, should not be considered serious, because only those properties upon which no exploitation work has yet been done are brought into control, and these—or the majority—have been held presumably for speculative reasons.

Art. 1 acts, on the other hand, rather in favor of companies having established rights over properties, as their present rights remain valid and cannot be attacked or limited during the period of application of the new law, although it prevents further exploitation on other lands, or transmission of existing rights, and is thus an infringement on the "right" of free sale or mortgage of holdings.

ITEMS FROM TEXAS AND LOUISIANA OIL FIELDS

WHITE AND HUMBLE COMPANIES PLAN TO ADD TO TEXAS PLANTS

The White Oil Corporation of Delaware has decided to build a 15,000-bbl. light oil refinery on the Texas Gulf coast, to be connected to the mid-continent oil-fields by an 8-in. pipe line, 400 miles long. P. J. White, president; Thomas White, vice-president; and Louis E. Stoddard and George E. Colvin, directors, have recently visited Houston and a decision as to the site of the refinery is expected shortly. The pipe necessary has been purchased from the National Tube Co., and the construction will be in the hands of the J. G. White Co., and Stone and Webster. To handle its increasing capacity in the Homer, La., field, the White Oil Corporation will install twenty 50,000-bbl. steel tanks there.

The business of the Humble Oil and Refining Co. has expanded to such an extent that the capital stock will be increased from $8,200,000 to $25,000,000. The company owns leases on extensive areas in Texas, Oklahoma and Louisiana, with lesser holdings in Wyoming. Eighty-one wells, 60 of them producers, were drilled in the past year in west and northwest Texas, and 154 are now being drilled. In the Gulf coast district, 19 wells were drilled, 12 being producers, and 20 wells are now being put down. The company has 3,000,000 bbl. of oil in storage, which is a little more than three months' production. The 8-in. main trunk pipe line from Stevens County to Texas City, Galveston County, with a daily capacity of 20,000 bbl., is expected to be finished by Jan. 1, 1920. The 8-in. line from the West Columbia field to the Webster

tank farm, 50 miles long, with a daily capacity of 14,000 bbl., was put into operation last July. A 10,000 bbl. refinery at Baytown, near Goose Creek, will be in operation, it is hoped, in June, 1920. Provision will be made for increasing the capacity later, as has been done at the San Antonio refinery, which is now handling 2,000 bbl. daily of crude supplied by rail from Burkburnett. Two casinghead gasoline plants at Iowa Park, Tex., and Healdton, Okla., are making 2,500 bbl. of gasoline daily, and a third plant, with a capacity of 1,500 bbl., is being built near Burkburnett at a cost of about $100,000. A skimming plant is under construction at Comyn, Comanche County, for treating Ranger and Desdemona crude oils before sending them to storage. A dock at Texas City, sufficiently large to load two tank steamers at a time, has been built. The extensive development in all of these fields has necessitated an extensive building campaign to house employees, especially at Cisco. A new six-story office building will be erected, fronting on Polk St., Houston, to cost $1,000,000.

OIL BOOM AFFECTS OTHER INDUSTRIES

Industries other than oil are soon called into being in districts where petroleum is found. A new telephone corporation, capitalized at $1,000,000, has been organized by Eastland, Tex., men to serve the Central-West-Texas oil region. The company has been financed, and long distance service with Dallas and Fort Worth will be installed.

The Lucey Mfg. Co., of Houston, will expend about $1,000,000 on a steel plant and a new factory for the manufacture of oil well equipment and supplies; and 800 to 1,000 men will be employed. The new plant will be so arranged that the capacity can be greatly enlarged in a short time, and it will, it is expected, eventually be the largest of the company's works. The old plant will be temporarily doubled in size to fill present demands.

PIPE-LINE OWNERS FEAR BEING MULCTED

The proposal of the Texas Railroad Commission that pipe lines cannot be laid without securing the written permission of the owners of the land over which the lines pass, is being opposed by the oil companies. The latter claim that gathering lines are laid in a rush to meet emergencies and that there is no time to obtain permission. Furthermore they argue that such a ruling would lay them open to the rapacity of some land owners on whose property, lines have already been laid without protest.

CLAIBORNE FIELD LACKS PIPE LINES

New Gushers Overtax Capacity—Much Property Changing Hands

Wonderful progress is being shown in the oil developments of northern Louisiana. Several large gushers have been brought in recently in the Homer field. One of the recent completions in Claiborne Parish is Gilliland & Foster's No. 6 Oaks, which is flowing over 5,000 bbl. daily through a 4-in. pipe line, 4 miles long, to Homer. This well was drilled as an offset to Standard Oil Co.'s No. 1 Oaks, the first big well completed in the deep sand. These operators are drilling several other wells. The Louisiana Oil & Refining Co., in the Claiborne field, completed its No. 4 Jackson well recently, and this is producing satisfactorily. No. 9 well of the Fortuna Oil and Gas Co. in the Bull Bayou district, is now making 1,000 bbl. daily from 2,750 ft., a greater depth than former producing wells had reached.

The Claiborne field is held back on account of insufficient pipe line capacity. The Sinclair Consolidated Oil Co. has completed survey of its pipe line from Cisco, on the Houston ship channel, Harris County, Texas, to Mansfield, La., and the Homer field. The line will be 226 miles long and will have three pumping stations. The Simms Oil Co. will also build a 6-in. pipe line, 20 miles long to its projected tank farm at Sibley.

Considerable property is changing hands in northern Louisiana. Recently the Simms Oil Co., of Houston, Tex., bought the holdings of the Rowe Oil Co., in the Homer field for a price reported to be $9,000,000. The property has several producing wells and is making 15,000 bbl. daily. The Simms Oil Co. has also purchased a one-third interest in the 3-in. pipe line of the Claiborne Pipe Line & Refining Co. from the Homer field to the loading racks on the railroad at Homer. H. T. Stati and associates, of Houston, Tex., connected with the Simms Oil Co., have purchased the property of the Frost Oil Co., with four producing wells, for the reported price of $1,500,000.

LEGAL HAPPENINGS AT AUSTIN, TEXAS

Several oil companies have recently been chartered at Austin, the largest being the Duquesne Oil Corporation of Wilmington, Del., with a capital stock of $5,000,000, and headquarters at Eastland. The West Texas Oil Co., of Wilmington, Del., has a capital stock of $1,000,000. The United States Oil Co., also of Wilmington, has a capital of $2,000,000, and the Belle City Oil Co., with workings in Cement County, Oklahoma, is capitalized at $500,000.

The suit between A. Goldman and the Invincible Oil Co., in which 160 acres in the Landslide tract of the Humble field, and the oil removed from it, were involved, has been settled in favor of the defendants. The plaintiff, as shown by the evidence, did not have a grant from the state for the land.—The Burk-Senator oil land dispute was discussed at a joint meeting of representatives of Texas and Oklahoma at Fort Worth beginning Nov. 20. The governors and attorney-generals of both states were present. It was agreed that for the present the district judge having jurisdiction over the boundary lines shall act as receiver, operate the wells, sell the oil, and hold the receipts until such time as the U. S. Supreme Court shall finally decide which state owns the land. In a later statement, Attorney-General C. M. Cureton, of Texas, said he would go to Washington and resist all efforts by Oklahoma to obtain control of the Burk-Senator oil property through the Supreme Court. The suit by the state to retain option on the Bassett Blakely lands at Blue Ridge has been postponed until the next term of the district court in January, 1920.. No steps, however, will be taken to prevent drilling on this land in an attempt to find oil.

PERSONAL ITEMS

Grover Hartt, formerly a member of the faculty of the University of Texas, and later an attorney in Ranger, has been appointed president of the American Oil & Refining Association, of Ranger.

E. F. Simms, president of the Simms Petroleum Co.; Oscar L. Gubelman, of Knauth, Nachod & Kuhne, and Thomas Streeter, vice-president of the American International Corporation, were recent visitors in Claiborne Parish, La.

A. C. Veatch has been appointed by the Sinclair Consolidated Oil Corporation to search for oil in promising districts. Mr. Veatch was formerly connected with the Lord Cowdray interests in England and was the discoverer of the petroleum deposits in that country.

James P. Nash has been named by the oil division of the Texas Railroad Commission as one of the supervisors for Eastland and Stephens Counties. Mr. Nash was formerly connected with the state highway department and with the University of Texas Bureau of Economics.

Olaf J. Perkins has severed his connection with the Arizona State Bureau of Mines to enter the employment of the Pearson syndicate. Mr. Perkins has gathered the greater portion of the data for the geographic base map of Arizona now being compiled, and has also had charge of mapping and investigational work in several sections of the state.

By The Way

A Mining Song

There is lots of gold in the ore of life
When men extract it all;
In the stream of woe, or the fire of strife
It does us good to fall.
While the poison lies of a misplaced trust,
Should teach us to be true,
As although our bodies may turn to dust,
The golden soul is you.
And the gold remains when the slag sloughs off,
To the real, true metal our caps we doff.

—L. M. Weston.

Wanted a Metallurgist with Wheels

To have a bonanza on your hands and yet be able to interest no one in it is most tantalizing. But when this state of affairs is owing to the lack of a metallurgist with sufficient ability to detect the value in the ore, it is also most surprising and the profession should take notice. To this end we publish below a letter received from G. A. E. Martin, druggist and physician of Adona, Ark. Will some metallurgist whose wheels are running as they should, kindly lend a hand to Mr. Martin and thereby aid the mining industry at the same time?

The Adona Irido Mining Co.'s wealth consists only of the immense deposits of the metals iridosmine, ruthenium, palladium, gold, silver, copper and vanadate of iron, heterogeneously mixed in gangues of sandstone, shale, coal and blue-clay, and this known only to the writer, notwithstanding the fact that many of the best-informed metallurgists have had samples of these different gangues to test for these metals. I know they only gave them a specular examination. Surely if they had put any of the many samples they have been presented with to test they would have found at least one or two of these many metals in it, for I have failed in no one of the many thousand that I have examined, and me only an amateur—learned all I know without a teacher.

I am enclosing you a small sample, though large enough to produce an acid-test sample. I ask that you kindly look out for a metallurgist that hasn't got his wheels of locomotion so deep in the ruts of classical metallurgy that he cannot get out of the adamantine walls of the idea that everything that is has long since been known to the scientists; and that because these metals have never before been found in these gangues it is impossible for them to contain them—and he will find the metals as I say.

I should admit that I sent a sample each of the shale and standstone gangues to John Ogden, then of Philadelphia but now of Denver, who did examine the shale-gangue and found platinum, gold, and silver; the sand-stone gangue was the richer of the two, but its values were mostly iridosmine.

To get the sample from the gangue, first crush the gangue in a clean agate mortar to a fine powder; then lift it out of the gangue substance by carefully stirring a smooth well-magnetized penknife blade in the gangue, jarring the microscopical, flat, metallic granules that adhere to it on to a smooth oiled paper; then jar it from the paper into a dry clean test tube and it is ready for the nitromuriatic acid. And it generally needs to be fortified with sulphuric acid.

I have written to the "Patent News" for advice about my discovery being of sufficient merit for a patent, but have not yet heard from them. Will you kindly give me such advice.

What Was the Sentence Pronounced?

The State Corporation Department of California has issued a bulletin announcing that "Diamondfield Jack" Davis, who was arrested some time ago in San Francisco charged with violating the provisions of the Corporate Securities Act, has been found guilty by Judge Oppenheim in San Francisco. Davis was accused of having made frequent and successive sales in California of shares of stock of the Silver Reef Divide Mining Co., a Nevada corporation, which had been issued to him in Nevada, without having first obtained from the Commissioner of Corporations of California a certificate authorizing him to do so. The bulletin states further:

Judge Oppenheim, in pronouncing judgment upon Davis, declared that he was convinced of Davis' guilt and intended to see that the provisions of the Corporate Securities Act were enforced, and, if he was found at any future time violating any of the provisions of the act in connection with the sale of corporation stock, he (Judge Oppenheim) would see that Davis would be severely dealt with.

Commissioner of Corporations E. C. Bellows, in commenting upon the outcome of the charges against Davis, declared that it is his purpose to take every means provided by law to put a stop in California to the operations of such dealers as "Diamondfield Jack" Davis.

California is fortunate in having a Blue Sky law and an official who will enforce it. Experience has shown, however, that only the imposition of severe penalties will make the fractious obey.

Dan McGann Declares Himself

BY EDGAR A. GUEST

Said Dan McGann to a foreign man who worked at the self-same bench,
"Let me tell you this," and, for emphasis, he flourished a Stilson wrench.
"Don't talk to me of the bourgoissee, don't open your mouth to speak
Of your socialists or your anarchists, don't mention the bolsheveek,
For I've had enough of their foreign stuff, I'm sick as a man can be
Of the speech of hate, and I'm tellin' you straight that this is the land for me!

"If you want to brag, just take that flag an' boast of its field o' blue,
An' praise the dead an' the blood they shed for the peace o' the likes o' you.
I'll hear no more," and he waved once more, his wrench in a forceful way,
"O, the cunning creed o' some Russian breed. I stand for the U. S. A.!
I'm done with your fads, and your wild-eyed lads, don't flourish your rag o' red
Where I can see, or at night there'll be tall candles around your bed.

"So tip your hat to a flag like that! Thank God for its stripes and stars!
Thank God you're here where the roads are clear, away from your kings and czars.
I can't just say what I feel today, for I'm not a talkin' man,
But first an' last, I am standin' fast for all that's American.
So don't you speak of the bolsheveek, it's sick of that stuff I am,
One God, one flag is the creed I brag! I'm boosting for Uncle Sam."

—Ax-i-dent Ax.

PERSONALS

W. H. Goodchild has left England for South Africa.

William Cullen has left England for South Africa, where he will remain for six months.

Harley C. Hooper has left Burma for Australia, where he expects to remain until March, 1920.

E. F. Yates, formerly of the Miami Copper Co., has been appointed city engineer of Globe, Ariz.

C. W. Purington has returned to England from Eastern Siberia and the Federated Malay States.

T. R. Jones, for many years manager of the Buffalo mine, Cobalt, has returned to the United States.

H. M. Gallagher has been appointed general auditor of the Phelps Dodge Corporation, with headquarters in Douglas.

Walter Lyman Brown has returned to London from Holland and is in charge of the operations instituted by Mr. Hoover for relief in eastern Europe.

Horace F. Lunt, State Commissioner of Mines of Colorado, with **Bulkeley Wells,** visited the mines of the Radium Co. of Colorado early in November.

E. W. Martin, A. T. Roos, Burt Rogers, and **W. H. Seaman,** all of Deadwood, S. D., attended the meeting of the American Mining Congress at St. Louis.

J. G. Lawn has left England on his return to South Africa to take up the position of managing director to the Johannesburg Consolidated Investment Co., Ltd.

R. M. Thompson, of New York, has entered the Matachewan mining field of Northern Ontario and taken an option on four claims adjoining the Matechewan mine.

Ralph S. Rainsford, formerly with J. G. White & Co., has become vice-president of W. B. Richards & Co., accountants and engineers, of 71 Broadway, New York.

A. J. Robin has severed his connection with the Mazapil Copper Co. and has accepted a position in Aguascalientes, Mexico, with the American Smelting & Refining Co.

Sergio Bagnara is consulting engineer and general manager of the Marine & Commerce Pocahontas Corporation, one of the large operators of the Pocahontas field in West Virginia.

Thomas H. Tulloch has resigned as general superintendent of the Chestatee Pyrites & Chemical Corporation to accept a position with the American Venture & Mines Corporation, Thomson, Ga.

C. F. Mason, after completing the installation of powdered-coal equipment at the Hayden, Ariz., smelter, is visiting the various smelting centers of Arizona before returning to his home in Canton, Ohio.

B. O. Pickard, engineer in charge of the Bureau of Mines station at the Michigan College of Mines, left for Hibbing, Minn., on Nov. 15, to attend a conference of the safety men of Pickands, Mather & Co.

Jesse Butler has been appointed superintendent of the Michigan mine in Ontonagon County, Mich., succeeding the late Samuel Brady. Mr. Butler, who is a graduate of the Michigan College of Mines, worked under Mr. Brady for two years and has intimate knowledge of the property.

J. A. BATTLE, JR.

J. A. Battle, Jr. is now in private practice. As stated in the "Journal" of Oct. 25, Mr. Battle resigned recently as acting chief engineer in the investigation of claims filed with the War Minerals Relief Commission.

William Boyce Thompson, of New York, has been in Phoenix, Ariz., visiting his brother, **J. E. Thompson.** Colonel Thompson, accompanied by **Charles Ayers,** president, and **W. C. Browning,** manager of the Magma Copper Co., will visit the holdings of that company, in which he is heavily interested.

Horace V. Winchell and **Bradley Stoughton,** president and secretary, respectively, of the American Institute of Mining and Metallurgical Engineers, are on a trip through the Western States, during which they will visit all of the local sections of the Institute. They will be absent about two months.

Robert R. Boyd has accepted appointment as assistant superintendent of mines at Bisbee, Ariz., for the Copper Queen branch of the Phelps Dodge Corporation. Mr. Boyd has resided for fifteen years in the Globe section, where he was connected with the Warrior, Old Dominion, and Arizona Commercial companies.

OBITUARY

J. W. Moffett, former manager of the Beaver and Temiskaming mines, Cobalt, and a pioneer of the Cobalt camp, died recently from tuberculosis at Haileybury, Ont., after a long illness. He was about forty-five years old and a native of Missouri. In his younger days he was engaged in mining in the Joplin district, and came to Canada about fourteen years ago. He designed and built the Beaver and other mills, and afterward became superintendent of the Beaver and Temiskaming mines. Mr. Moffett leaves a widow and one child.

Benjamin Hollinger, a noted prospector and mining man of Northern Ontario, and the discoverer of the Hollinger mine of Porcupine, died suddenly from heart failure at his home in Pembroke, Ont., on Nov. 26. He was thirty-four years old. He was born at Chalk River, Ont., and engaged in prospecting when quite young. His labors yielded little result for some years, until the discovery of the Hollinger, his share of which was estimated at $250,000. The Hollinger Reserve was another of his fortunate discoveries, and he was interested in a number of other properties. Mr. Hollinger was apparently in good health up to the time of his death, and had just returned from a deer-hunting expedition. He is survived by a widow and three children.

SOCIETIES

Idaho Society of Engineers has voted to affiliate with the American Association of Engineers under the title of the Idaho Society of Engineers Chapter of the American Association of Engineers.

Canadian Mining Institute held its annual general meeting at the Hotel Vancouver, Vancouver, B. C., Nov. 26-28, 1919. A number of interesting and practical papers were on the program. An account of the proceedings will be published later.

American Institute of Mining Engineers.—The Puget Sound Section held its annual meeting at the Faculty Club Building, University of Washington,

on Nov. 12. Following the usual dinner, the secretary's report was presented and officers were elected. The Montana Section held a meeting at the Montana Hotel, Butte, on Nov. 8, 97 members being present. Addresses were made by Frederick Laist, H. J. Maguire, James K. Murphy, and E. B. Young.

Rice Lake Mine Operators' Association.—At a meeting of mining men interested in the Rice Lake gold field of Manitoba, held in Winnipeg, Nov. 21, preliminary steps were taken toward forming an organization under the above title, with the object of improving transportation conditions and otherwise promoting mining interests. A committee consisting of J. W. Harris, F. O. Fowler, Col. A. C. Gray, Joseph Myers and Gordon McTavish was appointed to draft a constitution and by-laws.

INDUSTRIAL NEWS

Pittsburgh Testing Laboratory announces the death of William Frazier Carpenter, second vice-president, on Oct. 10.

International Exposition of Mining Industry will be opened to visitors on Dec. 1, but it will not be complete, as many exhibitors have not yet been able to arrange their exhibits. It is expected that everything will be in condition for the formal opening on Jan. 1, 1920.

Parsons-Moorhead Machinery Co., Hostetter Bldg., 237 Fourth Ave., Pittsburgh, has been organized to do a general machinery business. William L. Moorhead, of this company, was formerly vice-president of the Duquesne Electric & Manufacturing Co. Mr. Parsons has been doing a general machinery business for several years.

Redwood Manufacturing Co. was awarded a contract by the Butte Water Co., in October, 1919, for twenty-four miles of 26 and 24-in. Remco continuous stave pipe for additional water supply, this line to run from the pumping plant on the Big Hole River to a connection with the city water system. In 1892 the Redwood Manufacturing Co. installed a line of pipe 46,000 ft. in length and 24 in. in diameter, and in 1899 it installed 64,700 ft. of 24-in. and 32,000 ft. of 26-in. pipe, also for the Butte water supply. The lines installed in 1892 and 1899 were thoroughly examined in October, 1919, and found to be free from deterioration, the redwood showing no decay and being in its original condition. The pipe lines have operated continuously since they were installed, notwithstanding the fact that they are situated in a climate where the temperature goes 50 deg. below zero at times. Mr. Eugene Carroll has been general-manager of the Butte Water Co. since 1892, when the first line was installed. The fact that he gave the last contract to the Redwood Manufacturers Co. may be taken as evidence that the Remco pipe gave satisfactory service.

TRADE CATALOGS

D F C Melting Furnaces. Bulletin No. 450. Denver Fire Clay Co., Denver, Col. 7 x 10 in.; 20 pp., illustrated.

Imperial Incandescent Headlights for Electric Traction and Mining Service. Ohio Brass Co., Mansfield, Ohio. Catalog No. 205. 6 x 9; 96 pp., illustrated.

Black & Decker Electric Air Compressors, Portable Electric Drills and Electric Valve Grinders. Black & Decker Mfg. Co., Baltimore, Md. 8½ x 11; 31 pp., illustrated.

Concrete Pipe. American Concrete Pipe Association, 210 S. La Salle St., Chicago, Ill.; 8½x11; 12 pp.; illustrated. Booklet aiming to show the broad field for concrete pipe and adaptability for its many uses.

Concrete Tanks for Industrial Purposes. Portland Cement Association, 111 W. Washington, St., Chicago, Ill.; 6x9; 35 pp.; illustrated. Gives examples of concrete tanks used in different industries for storing various liquids, covering water, mineral oils, salt brine, chemical solutions, etc. In the mining industry concrete tanks are used as depositing tanks in electrolytic refining, for storing sulphuric acid and for slime-settling.

Bacharach Industrial Instrument Co., of Pittsburgh, Pa., has recently issued two new pamphlets as follows. Pamphlet P, on "Pitot Tubes and Orifices for Measuring the Flow of Gas in Connection With Hydro Flow Meters," and Catalog F, describing a new pressure-volume indicator for the control of air delivery to cupolas, suitable for either permanent installations or testing purposes.

NEW PATENTS

U. S. patent specifications may be obtained from the Patent Office, Washington, D. C., at 5c. each.

Alloys—Manufacture of Metal Alloys. William Lawrence Turner and Harold Alexandre Blackwell. (1,321,684; Nov. 11, 1919.)

Cement—Process and Apparatus for Cooling Cement-Kiln Gases and the Recovery of Dust Therefrom. Levi Stevens. (1,315,254; Sept. 9, 1919.)

Conveyor-Belt Drive. Charles Piez, assignor to Link-Belt Co. (1,319,109; Oct. 21, 1919.)

Crushing — Pulverizing-Mill Roller and Supporting Structure for Same. Robert A. Lachmann, assignor to Raymond Brothers Impact Pulverizer Co. (1,321,379; Nov. 11, 1919.)

Drills—Mounting for Hammer-Drills. William A. Smith, assignor to Ingersoll-Rand Co. (1,321,565; Nov. 11, 1919.)

Electric Furnace for Heating, Annealing and Melting Metallic Material. Mario Fossati, assignor to Societa Anonima Stabilimenti Biak. (1,322,416; Nov. 18, 1919.)

Fuel—Method and Apparatus for Feeding Pulverized Fuel. Cloise H. Baldwin. (1,320,963; Nov. 4, 1919.)

Grizzly for Ore Separation. William Ross. (1,321,716; Nov. 11, 1919.)

Mining and Quarrying Machine. Cyrus S. Oldroyd. (1,321,840; Nov. 18, 1919.)

Nitrogen—Process for the Fixation of Nitrogen. Frank L. Slocum. (1,318,929; Oct. 14, 1919.)

Oil-Well Screen. Clarence N. Scott, assignor, by mesne assignments, to The Texas Co. (14,756; Nov. 18, 1919.)

Ore Concentrator. William F. Walda, assignor to Deister Concentrator Co. (1,321,577; Nov. 11, 1919.)

Roasting—Rotary Furnace for Roasting Blende, Pyrites, or Other Minerals. Henry Charles Bingham, assignor to Huntington, Heberlein & Co., Ltd. (1,322,223; Nov. 18, 1919.)

Separation — Ore-Separating Apparatus. Lewis H. Falley. (1,322,487; Nov. 18, 1919.)

Sulphuric Acid—Apparatus for the Fractional Distillation of Sulphuric Acid and Other Liquids. Henry Jander. (1,321,210; Nov. 11, 1919.)

Thorium—Recovery of Thorium. Magnus A. Goltz. (1,322,185; Nov. 18, 1919.)

Tungsten—Means and Method of Compressing Powdered Tungsten, Tantalum, and the Like into Crucible Form. Carl A. Pfanstiehl. (1,321,125; Nov. 11, 1919.)

Zinc—Recovery of Zinc by Electrolysis. Royale Hillman Stevens, assignor to Electrolytic Zinc Co. of Australasia, Proprietary Ltd. (1,322,071; Nov. 18, 1919.)

Zinc Oxide—Manufacture of Zinc Oxide. Frank G. Breyer, James A. Singmaster and Albert E. Hall, assignors to New Jersey Zinc Co., New York, N. Y. (1,322,088 to 1,322,091, inclusive; Nov. 18, 1919.)

Zinc Oxide. Manufacture of Zinc Oxide. James A. Singmaster, Frank G. Breyer and Earl H. Bunce, assignors to New Jersey Zinc Co. (1,322,142; Nov. 18, 1919.)

THE MINING NEWS

New York, December 6, 1919

Important Uranium Deposit in Wyoming

Fifty-Ton Plant to Treat Uranophane Ore

About a half mile north of Lusk, Converse County, Wyoming, a small town on the Chicago & Northwestern Railway, about twenty miles from the Nebraska border, is a small conical-shaped hill. This hill is about a quarter of a mile in circumference at its base and about 350 ft. high. The hill is known as "Silver Cliff Hill," and for years it was known to contain small amounts of copper and silver, but of too low grade to be commercial.

In the spring of 1918, Ross Lambert, a farmer, of Casper, Wyo., purchased some land near Lusk. Mr. Lambert desired to have this small hill excluded from the tract that he purchased, but the owner insisted that he must buy the tract intact, and thus Mr. Lambert was forced to pay for this seemingly worthless hill.

In looking over the small dumps of a silver mine that was abandoned about thirty years ago, Mr. Lambert's curiosity was aroused by the variety of colors of the rock. He sent ten samples to W. L. Piers, an assayer of Denver, Col., and requested Mr. Piers to make complete analyses on all the samples; he wanted to know what could cause this variation in color. Nine of the samples were found to contain small amounts of uranium and small amounts of copper and silver, and the rest consisted of silica. The tenth sample, however, ran more than 20 per cent U_3O_8. Thus was the deposit discovered. Later the property was acquired by the Lorimer Minerals Co., and several carloads of ore containing about 3 per cent U_3O_8 were shipped.

The uranium occurs intimately mixed with well-rounded grains of quartz, forming a quartzite bed lying between mica schist and granite. The ore is conspicuous for its wide variations in color and occurrence. The most typical is an olive-green color, occurring as a cementing material between the grains of quartz. In places, the color is masked by the oxides of copper and iron, and it is difficult to tell which is high-grade uranium and which is not. A variety containing much iron oxide has a rich chocolate-brown color, and in some instances it contains as much as 15 per cent U_3O_8. Then again other shades that are characteristic of uranium minerals contain only a trace. In places the ore is found having a variety of colors, but the uranium content may be fairly uniform. Dr. F. B. Laney and Dr. E. D. Larson, of the U. S. Geological Survey,[1] who made a study of the optical properties of the mineral, are of the opinion that it is identical with uranophane, a hydrated calcium silicate containing some barium and lead, to which the formula $CaO\ (UO_3)_2\ (SiO_2)_2 6\ H_2O$ has usually been assigned.

The chemical evidence of Dr. S. C. Lind and C. W. Davis (Op. cit.) does not substantiate the above optical investigations, but this may be due to the fact that it was impossible to obtain absolutely pure specimens, owing to the masked occurrence of the mineral. Dr. Laney's micro-photographs indicate that small amounts of uraninite U_3O_8 are present, which were introduced subsequent to the deposition of the sandstone and replaced the cementing materials, chiefly iron and copper oxide, to a less extent than the sand grains themselves. It also appears that the uranophane is an oxidation product of uraninite. If this is the case, this is the first occurrence known of a free higher oxide, and it has been suggested that the mineral be called "Lambertite," in honor of its discoverer. However, further chemical and optical investigations will be necessary to substantiate this evidence.

The Lorimer Minerals Co. has just completed a 50-ton wet gravity concentration plant to concentrate the low-grade material.

[1] "A New Deposit of Uranium Ore," by Dr. S. C. Lind and C. W. Davis, "Science," May 9, 1919, page 441.

The Wasapika Promotion

The promoters of the Wasapika property at West Shining Tree, northern Ontario, have now decided to form a new company which will take over the Wasapika and some adjoining properties, paying for them in stock. There will be 6,000,000 shares, having a par of $1 in the new company, so there should be enough to go around and suit everybody. Wasapika, with a capitalization of $1,000,000, has been selling above par. The property has been developed to a limited extent only, and not enough work has been done to indicate a sufficient tonnage of a grade of ore which will permit of profitable operation under present conditions of power and transportation.

National Mining Corporation Formed in London

Leading British Mining Houses Unite to Secure Dominant Position in World Industry

A company known as the National Mining Corporation, Ltd., has been organized in London, with an authorized share capital of £3,000,000, divided into 3,000,000 shares of £1 each. An issue of 2,500,000 shares of £1 each at par was advertised on Nov. 3 last, of which 2,000,000 shares had already been applied for by the directors and their associates. These directors, who include many well-known men, are as follows: Herbert Guedalla, chairman, managing director of the Imperial Foreign Corporation, Ltd.; John Alexander Agnew, director of Burma Corporation, Ltd.; Frederick William Baker, chairman of the Mexican Corporation, Ltd.; Stanley Christopherson, director of the New Consolidated Goldfields, Ltd.; Edward Mackay Edgar, partner of Sperling & Company, merchant bankers; Alexander Stanley Elmore, managing director of the Chemical & Metallurgical Corporation, Ltd.; Francis Algernon Govett, chairman of Lake View & Oroya Exploration, Ltd.; Berthold Kitzinger, director of the National Bank of South Africa, Ltd.; Walter McDermott, chairman, Consolidated Mines Selection Co., Ltd.; Henry Strakosch, managing director of Union Corporation, Ltd.; and Henry Steel, chairman of the United Steel Companies, Ltd.

The reasons for the formation of the National Mining Corporation are advertised by the company as follows:

"The principle of financial co-operation among the leading mining houses in this country has hitherto not been sufficiently considered as a material factor in the maintenance of the important position which British capital and enterprise have attained throughout the world. As a result, this country has to some extent lost the commanding position which it once held in the mining and metallurgical industries, the control of which has been secured by foreign capital, particularly in the United States and Germany, where the industry is vested in powerful corporations with great financial resources, supported by their banking institutions, and commanding the services of technical experts of the highest ability.

"The main reason that has brought about such loss of control is the fact

that, with one or two exceptions, the financial resources of any one mining house or group in this country have not been sufficient to undertake the provision of the capital necessary for large mineral industrial enterprises. As the advantages of financial co-operation have now been accepted, a number of the leading mining houses in the City of London have united in the formation of this company with a view to securing a dominant position in the industry.

"The major portion of the £2,000,000 capital privately subscribed (and forming part of the present issue of £2,500,000) has been applied for by and will be allotted to the co-operating mining houses, each of which will be represented by a director on the board.

"In addition to the advantages of financial co-operation, the company through its directorate will secure the benefit of the accumulated experience, financial, technical and local, of the gentlemen who have agreed to serve as directors, and through them of the mining houses which they represent."

More Michigan Copper Companies Insure Employees

The Mohawk, Wolverine, and Michigan mines, employing 2,000 men in all, have announced that life insurance policies have been given to all men on their forces. Two months ago the Calumet & Hecla company and subsidiaries, with a payroll totaling 11,000 men, determined upon this plan of insuring their men without cost to the latter. The Stanton properties make the second important group in the Michigan district to adopt the scheme. All employees are given policies dated Dec. 1, for sums ranging from $1,000 to $1,500, depending upon the length of time they have been with the company, this without cost to the men and without medical examination.

British Columbia's Gold Problem

With the depreciation in the purchasing power of gold, the system of taxation of gold mines of British Columbia has become obsolete and unfair, in the judgment of some members of the British Columbia Chamber of Mines. If the gold-mining industry is to be maintained, they hold, the fundamental principle in fixing taxes must be the ability of the properties assessed to pay. Owing to the fact that, since taxes were last adjusted, mining costs had practically doubled, a joint committee, representing the B. C. Chamber of Mines, the Canadian Mining Institute, and the mine owners, has been appointed to investigate the matter and submit a report with a view to making whatever representations are thought advisable to the provincial government.

Interest Awakening in Phosphate District of Idaho

BY R. N. BELL

The increasing demand for rock prosphate by agricultural interests, and advanced land values, have induced a sudden active interest in the phosphate field of southeastern Idaho, and several big deals are pending concerning the few privately owned properties that are not within the tracts withdrawn by the Government. At Paris, in Bear Lake County, the Western Phosphate Mining & Manufacturing Co. is shipping 2,000 tons of crude rock per month. It is building a three-mile railway spur to the mine and erecting a 250-ton mill for preparing the rock for market. A new double-track development tunnel is being driven, with two headings, at the rate of 600 ft. per month, the work being done by a prominent railway tunnel contractor. The deposit is a uniform vein of gray rock phosphate 7 ft. thick, with a 45 deg. dip, and is developed by adits. Its guaranteed shipments are 70 per cent tri-calcium phosphate, with not over 1 per cent iron and alumina.

The Waterloo mine, three miles from Montpelier, also in Bear Lake County, is likewise undertaking active operations, and for several months has been shipping a car a day of 70 per cent rock. Its resources are extensively developed through short crosscut tunnels and drifts. Other enterprises are on foot involving railway spur construction to deposits that have been shown to contain a huge tonnage in this county and adjoining counties. It looks as if an important new mining industry were being inaugurated in this great western phosphate field.

New Railway Sought From Elk Lake to Gowganda

The Ontario government has been asked to grant a charter for the construction of a light railway, such as was used in France, from Elk Lake to Gowganda. The present terminus of the Elk Lake branch of the Temiskaming & Northern Ontario Ry. is at Elk Lake, and the new road will make the connection to Gowganda. It is planned to use gasoline locomotives, which it is expected would be more economical. If this road should be built it would mean a great deal to this interesting camp. At the present time the only large producer is the Miller Lake O'Brien, but recent developments on the Castle property, which is being taken over by the Trethewey, point to another shipper in the near future. There are a number of other interesting and promising properties in the district, but development has been retarded by the excessive cost due to poor transportation.

The Magma Company Buys Three R Mine

The long-expected sale of the Three R mine to the Magma Copper Co. has at last been consummated, though the purchase price has not been announced. To work the property the Patagonia-Superior Copper Co. has been formed, of which W. C. Browning, general manager of the Magma company, will be general manager while retaining charge of the Magma interests at Superior. An offer of $20,000 has been made for the surface machinery, of which the ownership is now in litigation. The entire acreage is to be explored by diamond drilling. The mine has long been owned by R. R. Richardson, of Patagonia, Ariz. Prior to 1914 it was under bond to N. L. Amster, of Boston, who gave it up after making heavy shipments of ore. Later it was bonded by H. C. and H. M. Harrison, of San Antonio, Tex., for $500,000. They organized the Three R Mining & Milling Co. and built a 200-ton concentrator, which appears to have had only a small degree of success. For failure to meet payments, the property reverted to Richardson, and a receiver was appointed for such property as might belong to the defaulting corporation. The property is situated nine miles from Patagonia, in the Patagonia Mountains, and consists of 55 claims, or about 1,000 acres.

A. S. & R. Must Continue to Smelt Ore From Christmas Mine

The case of the Gila Copper Sulphide Co. against the American Smelting & Refining Co. was recently decided in favor of the former. Former president William H. Taft, acting as special master in the case, decided that the smelting company must keep the ten-year contract that it made three years ago to smelt 250 tons a day of the Gila company's ore. The mining company, which is operating the Christmas property in Gila County, Arizona, is said to have been saved from bankruptcy by the decision.

The company has been in the hands of a receiver since April, 1918, by reason of owing $690,000 to a trust company of New Haven, Conn., most of which has been paid off with funds derived from ore shipments delivered to the Hayden smeltery of the American Smelting & Refining Co., which is nine miles by rail from Christmas. Shipments have averaged about 3 per cent copper, and have netted the mining company about $30,000 a month. The smelting company claimed to have the right to break the contract, and maintained that recently it had been losing money on it.

PROGRESS OF MINING OPERATIONS

ARIZONA

Johnson—The Mines & Development Corporation of Arizona, formerly known as the Copper Chief, has struck two new veins of high-grade copper ore, one in the No. 1 shaft, the other in the No. 2 shaft, both places carrying native copper and glance. Shipments have been curtailed also by the Arizona United Mining Co., not to exceed 100 tons per day, in order to push the large amount of development work contemplated. It is understood that the machinery for the Keystone Mining Co.'s new concentrator is being purchased and will be shipped in the very near future.

ARKANSAS.

ZINC DISTRICT

Yellville—More activity is apparent in the northern Arkansas zinc feld than for two years past. Eastern chemical companies are bidding for the carbonate ores and are taking everything that is being offered at prices several dollars higher than the Joplin quotations for this ore. The specifications required are that the ore must carry approximately 40 per cent metallic zinc, and not over 2 per cent sulphur, 0.25 per cent lead and 2 per cent lime. Practically all the carbonate and silicate ores produced in the entire field come within this requirement, and it is thought now that a new market for the ores produced will be developed with the chemical companies.

VILLAGE OF ZINC, ARK., ON SUGAR ORCHARD CREEK, IN NORTH ARKANSAS ZINC DISTRICT

ZINC DISTRICT

At Zinc, the Salina company has started a new concentrating plant and is making a good production of jack.—J. B. Dyerle has leased the Boo-Gra-Loo company's mine and mill and is operating steadily.—J. H. Haddox, of Oklahoma City, president of the Magnolia Lead & Zinc Co., has put a force at work in the Tar Kiln mine.

The Katie mine, at Rush, is being developed by D. J. McCargar. Drifting on the 46-ft. level opened a small head of carbonate ore, and the ground looks promising.—The Michigan mine at Conville is to start development.

CALIFORNIA

Grass Valley—The Central Consolidated Mines will probably re-equip its old mill in about six months' time, redesigning it for amalgamation and flotation. The work of designing will be placed in the hands of Hamilton, Beauchamp & Woodworth, consulting metallurgical engineers, of San Francisco.

COLORADO

Aspen—Great activity is taking place in this one-time bonanza silver camp. Local people are organizing companies and are taking over options on properties that have been idle since the panic of 1893. A mill operating on the Little Annie property is treating custom ores from adjoining properties. Most of the ore, however, is coming from old dumps. The Highland Mary group, 1,500 ft. south of the Oakland, where discovery of rich silver ore was recently made, is again about to enter the ranks of the producers. The Smuggler mine is to be unwatered and shipments resumed as the owners of the company have settled their differences. The Newman Mining & Tunnel Co. has been especially successful. It was organized less than a year ago by local capital. Sixty thousand dollars was subscribed, and all of this amount has already been redeemed, and a 25 per cent dividend declared.

Cripple Creek—Stockholders of the Elkton company are considering the formation of a leasing company similar to that recently organized by the Isabella Mines Co. If suitable leases can be obtained the company plans an extensive prospecting campaign.

Durango—The company operating the Southern Boy has opened up a high-grade shoot of gold ore 4 ft. wide and 90 ft. long. The vein is in a monzonite porphyry intrusion in the Dolores formation.

Leadville—A. A. Garret, promotor of the Prospect Mountain Tunnel Co. has announced that the company has opened offices in the Bank-Annex building, Leadville, and that he is making necessary arrangements preparatory to commencing operations early next spring. This company will undertake the development of the Canterbury Hill district, two miles northeast of Leadville.

Empire—The Primrose Exploration Co. has a crew of men at work at Urad constructing a 200-ton aerial tramway. Development work is being carried on at the upper mine and considerable ore is being blocked out.

Boulder—Fluorspar is being gradually resumed and the outlook for the fluorspar mines is more favorable than any period since the signing of the armistice. Then the market price slumped so as to make it impossible for the mines to operate. But recently Hibbs & Co., of Boulder, obtained substantial contracts for the delivery of high-grade concentrates to Eastern markets, so that the fluorspar mines and milling plants are now gradually resuming operations on a vigorous scale. Crude ore is hauled from various mines such as the Emmet, the Alice, the Argo and Humboldt, by auto truck to either the Lehman mill or the Colorado Pitchblende mill. By ordinary table concentration a 92 per cent fluorspar concentrate is obtained; 500 tons of these concentrates are being produced monthly.

IDAHO

Leadore and Gilmore Districts

BY R. N. BELL

Leadore—Recent development has disclosed one of the most promising lead-silver deposits that has been discovered in the state for years on the

Kimmel group adjoining the Sunset mine. The Sunset has been mined in a desultory fashion for several years and is credited with probably 150 car-load shipments of ore, one-third of which was 50 per cent lead and 50 oz. silver, the balance being varying grades of concentrates and second class ore.

The newly discovered deposit is on a contact between lake bed gravel and blue carboniferous lime with a 30 deg. dip in favor of crosscut tunnel work and lies near the edge of a broad valley at the foot of the main range of the Rocky Mountains. This limestone zone is 50 ft. thick and is paralleled by a belt of quartz porphyry or silicious igneous rock 2,000 ft. thick. The Kimmel development showed that the contact between the limestone and the porphyry was mineralized, the mineralization penetrating the porphyry. Considerable crosscutting has been done. Some of the faces show 10 to 15 per cent lead ore, but it is believed the whole mass will be low grade, probably as low as 2 per cent on the average. The ore carries about an ounce of silver to the unit of lead. The porphyry is fractured and could probably be readily caved. The deposit may possibly yield a large tonnage of low-grade lead-silver ore that may warrant large milling equipment when more fully developed. The contact is traceable along the foot of the mountain for eight miles with occasional shallow development and a succession of bunches of good ore at intervals.

Gilmore—The Latest Out mine in the Gilmore district is working at the 600 level one of the best orebodies that it has ever had. The Pittsburgh-Idaho mine has recently extended its 700 level development, resulting in the disclosure of five distinct orebodies. Intersecting fissures and faults that were barren in the upper levels, here show good ore. The silver-gold contents show appreciable increase, the ore remaining completely oxidized. Rather serious water trouble encountered is believed to be caused by seepage from a drain tunnel that crosses the shaft workings and not due to ground water. These two properties have made a gross production of several million dollars at considerable profit. The entire output has been sent to Salt Lake City as crude ore. The present yield is about 2,000 tons per month, carrying 30 per cent lead and 15 oz. silver with 50c. to $1 gold per ton.

MICHIGAN

COPPER DISTRICT

The No. 8 shaft (Pontiac) of the Quincy Mining Co. is making the best showing in the history of the property. The openings in working ground at present total 4,580 ft. Sinking is in progress from the 71st level to the 72d. Sixteen levels are active from the 54th down. The tonnage of mass and barrel and ordinary ore will total 350,000 for 1919. All work in this shaft is confined to the east branch. Openings to the north at a distance of 2,000 ft. are in poor ground, which makes the outlook gloomy for Pontiac shaft No. 9. The lode continues to flatten with depth.

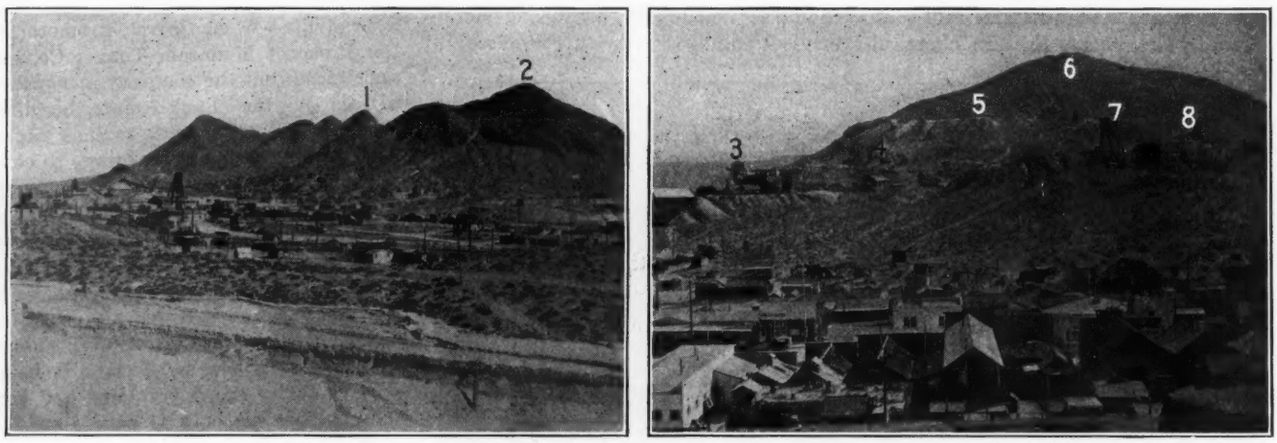
MINNESOTA

MESABI AND CUYUNA RANGES

Chisholm—The open pit portion of the Shenango Furnace Co. made its last steam-shovel shipment at the close of the present season. About 4,000,000 tons estimated in reserve will be mined by milling and scramming for which equipment will be placed during winter. With the cessation of open pit operations, the underground portion, which has been closed during most of the season, resumed operations with 20 gangs on double shift.—At the Billings property the main part of the development work has been completed and the three-shift system abandoned. Two shifts now employed on straight mining.—The Oliver Iron Mining Co. will open up its underground property to handle the shallow deposit on the forty south of the Tener prospect.

Biwabik—The American Bridge Co. recently received the contract for erecting a 250-ton steel coal trestle at the Biwabik property. The foundation is being laid.

Cuyuna—The main shaft of the Croft mine has been deepened 114 ft. A station is now being cut for development of a new main haulage level. At the Cuyuna-Duluth at Ironton, shipments discontinued and underground force laid off until further notice. The Northland is also down and it is not yet decided whether or not the property will be kept pumped during the winter. The latter was originally developed because of the demand for manganese.



WESTERN AND EASTERN PORTIONS, RESPECTIVELY, OF TONOPAH, NEV.
1. Mt. Butler 2. Mt. Brougher 3. Tonopah of Nevada 4. Montana Tonopah 5. North Star 6. Mt. Oddie 7. Silver Top Shaft 8. Desert Queen Shaft

NEVADA

Tonopah—The Tonopah Mining Co. has resumed shipment of ore which is now being treated in the Belmont mill. The West End Consolidated company recently announced a dividend of 5c. per share, payable Dec. 31. The California-Tonopah company has announced that final payment has been made to the defunct State Bank & Trust Co. by Stall brothers and associates for the California mine which adjoins the Jim Butler property in Tonopah.

Round Mountain—Plans of the Gibraltar Silver Mines for development of the Gibraltar property, which lies across Smoky Valley from Round Mountain, north of Tonopah, are being carried out under the direction of William J. Loring, president and general manager. The vein or mineralized zone is 87 ft. wide on the surface and from the high average of assays secured Mr. Loring believes it is one of the most promising prospects he has seen.—An

average of 40 tons of good grade ore is being treated in the Sunnyside mill at Round Mountain, and the Fairview mill is treating an average of 30 tons daily.

Midas—Two new orebodies, which were found during the last few months, are being developed in the Elko Prince mine in the Gold Circle district. The first was found on the 600 level, 1,200 ft. north of the main oreshoot which is 600 ft. in length. The new find has been developed for several hundred feet, the drift on the hanging-wall showing five feet of $25 ore, with no footwall in sight. The second new find was made on the 750 level, where from 8 to 14 in. of ore is said to run 300 oz. in silver, in addition to the gold. An unusual feature is the remarkable straightness of the vein and the smoothness of the hanging-wall.

Virginia City—The addition to the cyanide equipment of the Mexican mill has been housed in and the new filter has arrived and will soon be installed.

OKLAHOMA

ZINC-LEAD DISTRICT

Miami—Short line railroads serving the zinc mining district have been notified that they may have an unlimited amount of empty coal cars for ore shipments now. The coal strike has released the cars. Mining operators are preparing to take immediate advantage of the offer. The ore bins have been full since late summer. The car shortage has been acute since Sept. 1.

OREGON

SUMPTER-GRANITE DISTRICT

The old E. & E. Mine has been leased by John Arthur, and thirty men are employed overhauling the mill and on underground repairs. New machinery will soon be installed. This mine is on the same vein with the Columbia, Taber Fraction, Golconda, North and South Pole.—The Ibex is working another large vein developed to some extent by tunnels. The company recently purchased the mill of the Ball Mountain mine, and will begin operating it in the spring. The Ibex is about seven miles from Sumpter and the Sumpter Valley R. R.—In the Cable Cove district the Imperial mine, about twelve miles from Sumpter, has been shipping good ore steadily for the last few years, but it is difficult to get the ore to the railroad, as the roads are too poor to permit of auto-trucking.—The Powder River bridge, three miles below Sumpter, is operating steadily on good pay gravel.—The Sumpter Dredging Company has just purchased a dredge, which will start operations in the early spring, on some of the best ground in this section. All outside work has been done, and dredging will begin as soon as the Eastern Oregon Power Co. can furnish the power.

The Bonanza mine, about nine miles from Sumpter, is driving a new crosscut tunnel 500 ft. deeper than any other tunnel, thereby avoiding the present long tramway haul. The work will be completed this winter.—In the Greenhorn and Granite district, the Ben Harrison property has been shipping for over a year, and is now installing machinery to treat the ore on the ground, saving long hauls.—The Independence is milling ore developed last winter, and blocking out fresh ore.—The Buffalo mine, which has shipped ore steadily, has just opened up a 6-ft. vein of shipping ore. This mine is substituting machine drills for hand drilling. Its progress will be more rapid hereafter, but at present all chutes are full of ore, because snowfall has stopped auto-truck hauling.—A new property, the Continental, has just opened up a 3-ft. vein of high-grade ore, which the company is treating in its small mill. Development will be continued through the winter. A larger mill may be built in the spring.

The old La Bellevue mine is putting in a ball mill and a concentrating and cyaniding plant. The frame of the large mill is already in place. Some of the old workings are being retimbered. The ore carries a good percentage of silver.—The Monumental has considerable silver ore blocked out, and expects to start up in the spring.

SOUTH DAKOTA

BLACK HILLS DISTRICT

Lead—In the Homestake mine the water is now above the 700 level, and flooding of the 500 level is expected to be complete early in December. Unwatering will then be started immediately, and mining work should be resumed on the upper levels about the middle of the month. J. W. Dyer, engineer in charge of U. S. Bureau of Mines rescue car No. 5, which has been stationed at Lead during the Homestake fire, has been called to Mullan, Idaho, where a cave-in has entombed several men. Car No. 5 will remain in the Black Hills until the Homestake fire has been extinguished.

UTAH

TINTIC DISTRICT

Tintic shipments for the week ending Nov. 15 amounted to 140 cars, as compared with 118 cars the week preceding, several of the largest shippers almost doubling their output. Chief Consolidated shipped 38 cars; Dragon Consolidated, 19; Grand Central, 10; Iron Blossom, 17; Tintic Standard, 18; Centennial-Eureka, 9; Eagle and Blue Bell, 6; Colorado, 4; Swansea, 3; Mammoth, 3; Ridge and Valley, 2; Bullion Beck, 1; Victoria, 1; Eureka Hill, 1; Laclede, 1; and Sunbeam, 1.

Eureka—Suit has been filed by Tintic Standard against the Chief Consolidated to determine the ownership of White Wing No. 5 claim, the plaintiff alleging defendants to have included a part of this claim in the survey for a patent of Cedar No. 10. North Tintic Mining Co. is also suing the Chief Consolidated in regard to the Miller claim.—The Lehi Tintic Mining Co. is driving a 1,000-ft. tunnel to cut at depth three fissures that are mineral bearing in its upper workings. The bunkhouse has been completed.—At the Eureka Bullion mine a winze is being sunk from the 800 level to cut at depth the intersection of two fissures, and is now down 60 feet.—The Pinion Queen continues to sink its shaft.—The Apex Standard property, south and east of Tintic Standard, reports mineralization increasing 250 ft. out from shaft in the drift on the 900 level.—Ore is being mined at four places in the Tintic Standard. The recent find on the 1,350 level, a short distance southeast of older workings, is opening up satisfactorily. The management hopes to increase shipments to four cars daily.—The Colorado and Iron Blossom mines of the Knight interests are shipping under the leasing system. The October earnings of the latter property are stated to have exceeded $10,000. Considerable development is being done at both properties, but particularly at the Iron Blossom, where much deep work is in progress. Knights are also developing the eastern end of the district. From that section the Tintic Drain Tunnel will be extended to unwater the older part of the Tintic district. A shaft is being sunk in ground owned by the Tintic Drain Tunnel Co. not far from the tunnel portal, and is already down 150 ft. The same interests are also sinking a shaft at the Big Hill property in East Tintic.

WASHINGTON

Seattle—With a cargo of lumber, machinery and supplies, including a boiler weighing 44,000 lb., the steamship Norwood, under charter to the Alaska Sulphur Co., sailed from Seattle Nov. 6, for Akun Island, Western Alaska, where the company is developing valuable sulphur deposits and erecting a plant where the sulphur will be refined and shipped to Seattle. The steamship also carried 18 employees who will be engaged on construction of the plant and the completion of a two-mile aerial tram. T. H. Landswick, secretary of the company, states that the plant will have a capacity of 100 tons and by April of next year they expect to be supplying sulphur to Seattle and principally the paper mills of the Northwest. He states that the company has 400 acres of land on Akun Island and a large tonnage of sulphur already developed. He further states

that about $250,000 are being spent on the plant and aerial tramway. Another shipment of machinery for the smelter will be sent north during February.

WISCONSIN

ZINC-LEAD DISTRICT

Platteville—The Mineral Point Zinc Co. (Galena, Ill.) has opened a new shaft at Mifflin, Wis., on the Coker Range, and has resumed milling at the Coker mill No. 2.—Kistler & Stephens, Platteville, have started a new shaft on the Goke land, a half mile east of the Blockhouse mine.—At Shullsberg, the Little Giant mine, with its mill equipment, has been overhauled by T. A. Hansen and others, and mining operations are underway.

CANADA

BRITISH COLUMBIA

Barkerville—The Mining Corporation of Canada has undertaken the work of proving up the gold-quartz claims situated on Proserpine Mountain about four miles north of Barkerville, B. C. A promising discovery was made on this property about a year ago. It is said that the present work, which is being done under the direction of Robert H. Bryce, of Toronto, is expected to demonstrate by spring whether the mineralization continues at depth. A crew of more than fifty men is now at work. Cabins for 100 men have been built, as well as offices and other necessary buildings. A contract for driving two 200-ft. tunnels has been let to John Bell, and I. E. Moore has a contract for two others. Two diamond drills are being shipped to the property and will be at work before long. Work done thus far on the property is said to have shown an average gold content of $17 per ton. Many claims have been staked in the Barkerville section as a result of this company's activity.

Nelson—The ore of the California mine, which is near Nelson, is to be treated at the old Athabaska 10-stamp mill. A ball mill will be added to the equipment of the latter for primary grinding. The product after classification will be passed over Senn amalgamating tables and finally be treated by flotation. The capacity of the mill is small, about 25 or 30 tons, but may be increased. A recovery of 90 per cent is anticipated.

Kamloops—The difficulty of obtaining labor is hampering the completion of a number of British Columbia enterprises which are expected to benefit the mining industry. One of these is the branch line of the Canadian National Rys. between Kamloops and Kelowna by way of Grande Prairie and Vernon. Another is the branch railroad from the Kettle Valley Ry. to Copper Mountain, where the Canada Copper Corporation is opening up extensive deposits of low-grade ore on a large scale. A third is the construction by the Kootenay Power & Light Co. of its power line from Bonnington Falls, where the power is developed, to Princeton, where it is to be used by the Canada Copper Co. in its new mill. The new Kamloops-Kelowna branch road will afford transportation facilities necessary to the development of the gypsum deposits at Grande Prairie, which are owned by the Manitoba Gypsum Co. and said to be of great extent.

Trail—The practice of wet magnetic concentration has been successful in the test mills of the Consolidated Mining & Smelting Co. of Canada, at Trail. Success was first attained in the laboratory, then in the 150-ton test mill, which was later increased to 250-tons daily capacity. It is expected that equally good results will be obtained in the 600-ton temporary mill about to start operations. The practice may also be used as part of the treatment to be employed in a much larger concentrator to be constructed in the course of a year or two years.

Anyox—The Granby Consolidated Mining, Smelting & Power Co. blew in its fourth furnace here on Nov. 15, thus bringing the entire plant into operation for the first time since last spring. Restriction of operations had been caused by shortage of coke.

NOVA SCOTIA

Sydney—An option on a zinc-copper-lead property at Stirling, N. S., was recently acquired by Captain P. J. Webb, manager of the Sydney Investments Limited, at Sydney, from James Nolan of Glacé Bay, who is owner of the leases. It is claimed that over $40,000 has been spent in developing this property.

ONTARIO

Sudbury—The new smeltery of the British-American Nickel Co. at Nickelton, Ont., will be blown in about Dec. 1, it is expected. Two blast furnaces and two 13x30-ft. Pierce-Smith converters have been installed. This plant is the third to enter the nickel-copper field of the Sudbury district, the other two being the Mond Nickel Co. and the International Nickel Co. The head office of the British-American Co. is at Ottawa. W. A. Carlyle is general manager. The Mond company has one furnace in blast. The International Nickel Co. has increased its production to 3,000 tons of bessemer matte per month.

MEXICO

NORTHERN SONORA

Nacozari—A shortage of skilled miners and surface labor in this district has hampered operation of the various properties to a considerable extent. However, this camp is not alone in experiencing a labor shortage, which has been evident also in Cananea and other parts of Sonora. It is ascribed to the heavy drain of laborers secured by agents of farmers in the southwestern part of the United States to harvest their crops. Several thousand crossed the international boundary to work in the Salt River Valley picking cotton. These men and their families have only begun to return to their native land. Many others have gone as far east as Kansas to perform common labor for the railroads and other industrial enterprises. The statement was recently made that Nacozari could use between 300 and 400 men. Small properties in the outlying districts also are hampered by lack of pack animals, and fully 1,000 burros and mules could be used in the vicinity of Nacozari alone.

AUSTRALIA

Bendigo—The Bendigo Amalgamated Co. was formed several years ago to revive gold mining on the famous Bendigo field. The aim of the promoters was by centralizing the management to enable money that would otherwise be spent in administration and surface operations to be expended in underground developments. According to the report for the year ended July 1, the tonnage treated was 112,977 for a yield of 41,022, as against 146,769 for a yield of 41,130 oz. for the preceding period.

The financial position of the company is summed up in the following statement: Dec. 31, 1917, loss for 7 months, £38,459; June 30, 1918, loss for 6 months, £20,382; Dec. 31, 1919, loss for 6 months, £10,718; June 30, 1919, profit for 6 months, £2,934. One factor that has helped the company recently has been the premium obtained by the Gold Producers' Association on gold exported from Australia. The company's share amounted to £5,902.

Up to the present the company has not been fortunate in making any rich "strikes" such as have always been a feature of the Bendigo field, but should such good fortune be met with it would materially improve the position. Exceptionally good returns, however, have been obtained recently, particularly in the workings north from the Constellation shaft, where, within the last twelve months, gold to the value of about £40,000 has been recovered. The last week's milling of 314 tons from this reef gave a return of 604 oz. The aggregate output from the company's mines for a two-weeks period recently aggregated 417 tons for a yield of 2,140 oz. This is the best return obtained since the formation of the company and the only occasion on which it was exceeded was on Dec. 18, 1917, when the inclusion of 994 oz. of gold from the plates brought the fortnight's return to 2,196 oz.

THE MARKET REPORT

Daily and Weekly Metal and Mineral Prices, Metal Market Conditions, Average Monthly Prices, Stock Quotations

Silver and Sterling Exchange

Nov.	Sterling Exchange	Silver		Dec.	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
27	....	...	74	1	399¾	129½	73⅛
28	402½	129	72⅝	2	395	130½	73¾
29	400¼	129	72⅝	3	388¼	130¾	74⅜

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Daily Prices of Metals in New York

Nov. and Dec.	Copper	Tin	Lead		Zinc
	Electrolytic	Spot	N. Y.	St. L.	St. L.
27	.....	.....	.....	.....	.....
28	17⅛@18⅜	53⅜@53⅝	6.75@6.80	6.57½@6.62½	8.00
29	17⅛@18⅛	53⅛	6.75@6.80	6.57½@6.62½	8.05
1	17¾@18	53	6.75	6.50@6.55	8.05@8.10
2	17¾@18	52¾	6.75	6.50	8.10@8.15
3	17¾@18	52⅝@52¾	6.75	6.50	8.15@8.20

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis. Tin is quoted on the basis of American tin, 99 per cent grade.

London

Nov. and Dec.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3 M.	Spot	3 M.	Spot	3 M.
	Spot	3 M.							
27	95	96½	107	295½	296¾	36⅞	36¾	48	48½
28	95¼	96¾	106	296	297½	37½	37⅝	48	48¾
29	....	....	....	....	....	....	....	....	....
1	97	98½	105	295	296½	38	38¼	48⅞	49⅜
2	97¾	99¼	106	294¾	296	39¼	39⅜	49⅜	50¼
3	98¼	99½	107	294	296¼	37⅜	37⅜	50½	51¼

The above table gives the closing quotations on the London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb.

Metal Markets

New York—Dec. 3, 1919

The features of the metal markets this week were further weakness in copper and a more decided easing in lead. On the other hand, zinc became much stronger, on the transaction of large business.

Efforts are being made to advance transatlantic freight rates, by agreement, to the scale of the U. S. Shipping Board, but it is uncertain whether such an arrangement can be effected, or maintained if it be effected.

Transpacific freight rates from San Francisco to Hongkong and Kobe remain unchanged at $12.

The price for silver during the last week was erratic, reflecting speculative influences. However, high prices for this metal may be expected to continue for a long time. Asia has been draining the world of gold and silver, and will continue to do so as long as the black and yellow races work harder and sell the white men more than they buy in return.

On Dec. 2, gold in London went to 106s., a premium of 19s.

Copper

At the beginning of the week some small sales were made at 18⅜c., but before the end of the day copper was offered at 18c., delivered, although such offerings were not broadcast and did not immediately become generally known. As late as Saturday some small sales for export to Europe were booked as high as 18¼c., f.a.s., by sellers outside of the Export Association. On Dec. 1 copper was so freely offered at 18c., delivered, equivalent to 17⅞c., cash New York, that the market could no longer be considered any higher than that. On the basis of 18c., delivered, which price prevailed in all quarters since Monday, the market showed some resistance, and in spite of rumors to the contrary, there were no authentic reports of any sales at lower figures. All producers were emphatic in their refusal to sell anybody but consumers, there being a determined effort to keep copper out of speculative hands.

The sales of copper in November attained a surprisingly large figure. Sales during the last week amounted to considerably more than in the previous week. Sales of the week were mainly with wire-drawers, but the Export Association did a rather fair business, divided among numerous foreign countries, at prices decidedly better than what prevailed in this market. However, there was no general inquiry from domestic consumers, and nothing much is to be expected until there is a general belief that the present decline in the market has ended.

Copper Sheets—28½c. per lb. Wire, 22c. f.o.b. factory, weak. Domestic buying dull.

Tin

This market was erratic, owing to the fluctuations in the exchange rate and uncertainty about the deliveries from steamships arriving in this port. There was not much buying by domestic consumers and not much interest in the metal on their part.

Singapore quoted c.i.f., London, £288 on Nov. 27; £291½ on Nov. 28; £299 on Dec. 1, and £302½ on Dec. 2.

Though tin of 99 per cent grade declined in this market, Straits tin remained rather firm.

Lead

The easing tendency in the market continued, and by Nov. 29 there were sellers at 6.75c. New York other than the A. S. & R. Co. The St. Louis market was steady at about 6.60c. On Dec. 1 a round lot was bought in St. Louis at 6.50c. and on Dec. 2 and 3 other round lots at the same figure. On Dec. 2 a large lot was booked in the New York market at 6.75c. At the close the market was squarely on the basis of 6.75c., New York, and 6.50c., St. Louis, with numerous of the large producers sellers at those figures.

During the week a rather large business in the domestic market was transacted, corroders being heavy buyers. A large business was done in Mexican lead for export to Europe—England, France, and Germany being buyers. Europe has been buying more or less lead in this market for some time, taking especially Mexican lead for shipment from Tampico. This follows upon unexpected shortage of supplies in Europe, where consumption, especially in Great Britain, is good. The strikes in Australia resulted in a large loss of lead production, and the labor troubles in Spain have diminished supplies from that quarter. The cost of production in Spain is high. These influences indicate that Europe may have to get lead from here.

Zinc

Right from the beginning of the week there was powerful buying by speculative parties who accumulated large quantities, paying 8c. St. Louis, for any delivery, either prompt or first quarter. A domestic galvanizer who bought 500 tons on the same day paid 8c. for it. On Nov. 29 speculative interests bought at 8.05c. St. Louis, outbidding European buyers who offered to pay 8c., this being reckoned as the equivalent of £48 c.i.f., London. On Monday business was done in the morning at 8.05c. and later at 8.10c., a large lot of prompt zinc being booked for export at the latter figure. On Tuesday a large business for export was done at 8½c. More inquiry from galvanizers also developed on this day. At the close producers were asking 8.20c. With Wednesday, however, there was some relaxation in the demand and a development of some relatively low offerings, probably from sources that desired to realize. Transactions of the week were large, probably 6,000 or 7,000 tons having been sold for export, and, including speculative purchases, the total was doubtless upward of 10,000 tons.

Zinc Sheets—$11.00 per 100 lb. since Nov. 14, less 8 per cent on carload lots. Slightly higher prices for export.

Silver—The New York silver price broke violently on Nov. 27 on the announcement that the U. S. Treasury was paying out silver dollars in San Francisco in exchange for gold, dollar for dollar, and that silver dollars were being exported in large quantities tc China, thereby enabling buyers for export to obtain silver coin on the basis of $1.29 plus per fine ounce. Naturally, buyers for export declined to continue paying a large premium over the price at which they could obtain silver by shipping silver coin, and the New York price declined to $1.29. The Treasury Department has under advisement whether it will continue to pay out silver dollars in exchange for gold, and whether it will require the melting of coin before export. Notwithstanding the lack of definite official action, the demand for export continues, and buyers are paying a premium over the silver-dollar equivalent.

Mexican dollars at New York: Nov. 27, holiday; Nov. 28, 99⅞; Nov. 29, 99⅞; Dec. 1, 99½; Dec. 2, 100¾; Dec. 3, 101.

The Mexican government issues an official silver price on the last day of each month as a basis on which the export taxes on silver bullion for the month following are figured. This price is theoretically the average New York official quotation, taken from the 26th of one month to the 25th, inclusive, of the following month. For example, the Mexican government's official price for the month of November is calculated as the average of New York official quotation, beginning with Sept. 26 and ending with Oct. 25. The Mexican official price, as above stated, is used in calculating the value of silver put in the mint for export, and this same valuation is also used as a basis for express charges to the border.

The Mexican official prices for this year have been as follows:

Mex. per kg. fine Ag.	
January	P-65.16
February	65.16
March	65.16
April	64.84
May	64.94
June	68.14
July	71.24
August	72.06
September	70.96
October	71.80

The above prices are in Mexican gold and are transferred into U. S. Currency on the basis of 2:1.

Palladium—Advanced to $125.

Platinum—Early in the week rather large quantities were sold at $135, but about Dec. 1 the market experienced a sharp advance and closed at $145, $150 for refined ingot. The strike among the jewelry manufacturers relaxed demand for a while, but with the end of this labor trouble coming in sight, jewelers became more active buyers. Supplies are scarce. Whereas 100 oz. formerly used to be considered an ordinary wholesale lot of platinum, producers now do business in 20-oz. lots.

Aluminum—33c. per lb.

Antimony—There was considerable activity, with the market unchanged at 9@9½c. for spot, and the same for futures.

Bismuth—Unchanged at $2.96.

Cadmium—$1.40 per lb.

Nickel—Ingot, 42c.; shot, 43c.; electrolytic, 45c.

Quicksilver—This metal was firm at $95, a sharp advance from the previous week. The price in London advanced to £21½ today. San Francisco telegraphed $87.50, strong.

Monthly Average Prices for November

Lead, New York	6.808c
Lead, St. Louis	6.649c
Lead, London	£34.731
Zinc, New York	8.177c
Zinc, St. Louis	7.827c
Zinc, London	£46.583
Silver, New York	127.924c
Silver, London	70.065d
Copper, electrolytic, N. Y.	19.758c
Copper, standard, London	£98.894
Tin, New York	53.307c
Tin, London	£283.556
Bessemer pig iron, Pittsburgh	$31.60
Basic pig iron, Pittsburgh	$31.56
No. 2 foundry, Pittsburgh	$32.16

Tungsten Ore — Chinese wolframite was quoted at $7 per unit, Bolivian at $10. Business in scheelite was actually done at $10.

Molybdenum Ore—Quoted nominally at 75c.

Chrome Ore—Arrivals from South Africa are reported.

Zinc, Lead and Ore Markets

Joplin, Mo., Nov. 29—Zinc blende, per ton, high, $49.40; basis 60 per cent zinc, premium, $48.50; Prime Western, $47.50; fines and slimes, $45@42.50; calamine, basis 40 per cent zinc, $30. Average settling prices: Blende, $49.19; calamine, $33.45; all zinc ores, $45.15.

Lead, high, $89; basis 80 per cent lead, $88@85; average settling prices, all grades of lead, $87.09 per ton.

Shipments the week: Blende, 7,542; calamine, 29; lead, 1,038 tons. Value, all ores the week, $432,250.

Shipments eleven months: Blende, 437,348; calamine, 11,597; lead, 66,610 tons. Value, all ores, eleven months, $23,150,870.

With few cars provided for this week's loading, and prospects not encouraging for a larger number next week, and in the face of the threatened strike of railroad men, the market advanced $2.50 per ton this week, on the strength of a slight improvement in metal. Nearly all buyers were holding back on $45 offerings, until two or three came in with offerings of $47.50.

Platteville, Wis., Nov. 29—Blende, basis 60 per cent zinc, $51.50 base for premium grade and $50.50 base for Prime Western grade. Lead ore, basis 80 per cent lead, $85 per ton. Shipments reported for the week are 2,528 tons blende, 85 tons galena, and 85 tons sulphur ore. For the year to date the totals are 93,153 tons blende, 6,262 tons galena, and 17,731 tons sulphur ore. During the week 2,667 tons blende was shipped to separating plants.